Nature Magazine

VOLUME 44 NUMBER 9

NOVEMBER, 1951

50 CENTS

Keep Your Copies of Nature Magazine in this Fine Binder!

PRICED LOW

At $2.50

Your Name or Year Stamped in Gold for 50c extra. Both name and year for 75c.

Your money will be refunded if you are not entirely satisfied.

OPENS FLAT LIKE A BOOK.

NATURE MAGAZINE never grows old. It is more than a magazine; it is an encyclopedia of information on nature subjects, presented as attractively as fiction and illustrated so aptly as to make you a witness of the endless procession of nature happenings. Every issue of the magazine is worth keeping and reading again and again.

Thousands of subscribers bind their copies for the permanent preservation of the wealth of factual information they contain.

For your convenience and pleasure, we have selected the very best binder we could find. It is a handsome, finely grained dark green, gold-embossed binder—a creditable addition to any reading table or library. It is light, strong, and durable. Copies of the magazine can be inserted, one at a time, without cutting or punching, simply by the snap of a little unbreakable wire. And, best of all, it opens flat like a bound book which makes it easy to handle and to read.

Each binder will hold the issues of NATURE MAGAZINE for a full year—or as long as you wish to retain them in the binder. Meanwhile the contents are protected from handling, tearing and from being mislaid or carried away. Get greater enjoyment out of your magazines by binding them and by so doing make distinctive and welcome additions to your library. You can, in time, acquire a reference library on nature subjects beyond compare.

Mail your order with remittance to

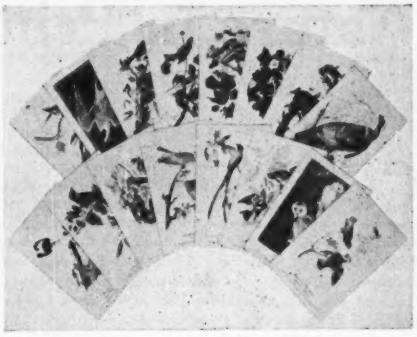
AMERICAN NATURE ASSOCIATION

1214 16th St., N. W. Washington 6, D. C.

Ideal Gifts for Christmas
and for all occasions

TREAT YOURSELF AND YOUR FRIENDS TO THESE EXCLUSIVE DOLLAR GIFTS

The various items listed are excellent for personal use and for gift purposes. Beautifully reproduced in full color on high grade paper stock, they show quality throughout. The subjects were painted by famous artists — the GAME BIRD FAMILIES and WILD BIRDS by Francis Lee Jaques; the AUDUBON PRINTS by John James Audubon; the FLOWERS by Kathleen Cassell; SONG-BIRD FAMILIES and the BUTTERFLIES, MOTHS and FLOWERS by Roger Tory Peterson.



Postal Cards

You can accomplish two valuable objectives in the purchase of these gift items. First, you get items designed for people of taste and discrimination at low cost. Secondly, you help finance the important conservation education activities of the Association because the small profit that would otherwise go to a retail store will be used for that purpose.

Take Your Pick of these DOLLAR GIFTS

CORRESPONDENCE NOTE PAPER. *These items packed 20 notes and 20 matching envelopes in an attractive gift box.*

Song Bird Notes — **Audubon Bird Notes**
Game Bird Notes — **Wild Flower Notes**
Wild Bird Notes — **Butterfly Notes**

POSTAL CARDS. *Packed 32 cards to a box, illustrated on extra heavy fine quality stock.*

Song Bird Post Cards — **Audubon Bird Post Cards**
Game Bird Post Cards — **Wild Flower Post Cards**
Wild Bird Post Cards — **Butterfly Post Cards**

LARGE PRINT SETS. *Each print set contains six prints size 8½ x 11. The subjects are carefully selected. They are ideal for framing, for mounting on wastebaskets, telephone book covers, etc.*

Song Bird Prints — **Audubon Bird Prints**
Game Bird Prints — **Wild Flower Prints**
Wild Bird Prints — **Butterfly Prints**

CHRISTMAS CARD AND GIFT CALENDARS. *Both calendars have a Christmas greeting page, a cover page, and twelve monthly pages, illustrated in full color. The calendars are bound with cord and packed six to a box with matching envelopes.*

Song Bird Christmas Card-Calendars
Butterfly Christmas Card-Calendars

1952 DAILY REMINDER CALENDAR: *Size 4 x 6 featuring 14 full color illustrations from the new Song Bird Family series by Roger Tory Peterson. Ninety-six pages providing ample space for daily notes, memoranda, telephone numbers and addresses. Complete with place marker.* **$1.00 Each**

Large Print Sets

BIRD-O-GAME

Interesting and educational for both children and adults. Provides hours of fun by learning to identify our feathered friends. Contains six playing boards, markers and calling cards. Can be played by any number from 1 to 6 players. **$1.00 Each**

Order Early to Avoid Delay

If you do not wish to mutilate your copy of the magazine and write separately, be sure to describe items desired.

Correspondence Notes

American Nature Association
1214 16th St., N.W.
Washington 6, D. C.

Enclosed is $_____ for _____ items as indicated, at $1.00 each.

(Be sure to show the number of boxes of each item desired)

- ☐ Song Bird Notes
- ☐ Game Bird Notes
- ☐ Wild Bird Notes
- ☐ Audubon Bird Notes
- ☐ Butterfly Notes
- ☐ Flower Notes
- ☐ Song Bird Post Cards
- ☐ Game Bird Post Cards
- ☐ Wild Bird Post Cards
- ☐ Audubon Bird Post Cards
- ☐ Flower Post Cards
- ☐ Butterfly Post Cards
- ☐ Song Bird Prints
- ☐ Game Bird Prints
- ☐ Wild Bird Prints
- ☐ Audubon Bird Prints
- ☐ Flower Prints
- ☐ Butterfly Prints
- ☐ Song Bird Christmas Card-Calendars
- ☐ Butterfly Christmas Card-Calendars
- ☐ 1952 Daily Reminder Calendar
- ☐ Bird-O-Game

NAME.....

Street and No.....

City.....Zone....State.....

Nature in Print

By HOWARD ZAHNISER

CONSERVATION as a movement enlisting an ever-increasing number of Americans is now so far advanced in time that we are looking back in biographical and autobiographical books on the lives and experiences of the second generation of its leaders. It is only a few years back that Linnie Marsh Wolfe's *Son of the Wilderness: The Life of John Muir* won the Pulitzer prize for biography, and even more recently that Gifford Pinchot's autobiographical *Breaking New Ground* was on the shelves or in the minds of many conservation readers. Indeed, both of these books are still practically current reading. Gifford Pinchot's reminiscences stir the admiration of those who are specially concerned with conservation as a wise use of the natural resources that are the commodities of our good living. Mrs. Wolfe's biography of Muir inspires anew those whose special interests are in the preservation of the superlative areas of our landscape and of our American wilderness. All of us should most certainly be concerned with both this conservation of our commodity resources and this preservation of unspoiled areas of wilderness, and as a people we *must* be so concerned if, in the public interest, we are to have both well-managed forests and well-preserved parks. Yet our first active pioneers, not to go so far back as to the prophets of the Nineteenth Century, called out for the appreciation and preservation of unspoiled areas, on the one hand, or, on the other, for the prudent use and husbandry of the resources that could be, with wisdom and knowledge, both exploited and conserved. Sometimes it even seems that those who were trying so hard to prove to industrial, free-enterprise America the soundness of a conservation policy of lumbering the forests without destroying them, were deeply embarrassed by the evangelists who sought to preserve some areas of wild forest land uncut and unentered by mechanization and industry. The crusaders for preservation, in turn, seemed only slightly less suspicious of the forest conservationists, who had to advocate cutting in order to be "practical," than they were of the lumbermen whose excesses were arousing all conservationists. Thus so many became either disciples of John Muir or else followers of Gifford Pinchot, without realizing the agreeable soundness of both — within their respectively appropriate realms, either of managed forests for commodity conservation, or of dedicated areas for the preservation of wildness.

Undoubtedly this dual or divided conservation concern arose (and continues) in the reality of our American circumstances, not simply in the varying interests and influence of the geniuses Muir and Pinchot. Not alone in the parallel development of national parks and national forests, but perhaps even more interestingly and dramatically is this conflict among the elect apparent in the history of the New York State Forest Preserve in the Adirondack Park and Catskill Park. Andrew Denny Rodgers III, who has turned from his biography-chronicles of plant science to foresty in *Bernhard Eduard Fernow: A Story of North American Forestry*, has through his valuable quotations from many sources called attention to this in several connections, and it is clear that the forester Fernow was deeply disturbed by the reservation of the Forest Preserve from all cutting. "The Adirondack preserve," writes Mr. Rodgers, "became in 1894 subject to a clause written into the New York State constitution which forbade the cutting of timber, dead or alive, on state lands. . . Fernow became so alarmed at the implications of this constitutional limitation that he questioned whether even forest planting was legal on the lands concerned. Obviously the intention of the clause, Article VII, section 7, was to keep the lands in a state of wild nature. This article of the New York constitution — today, Article XIV, section 1 — has played a much disputed role in the forestry of the state." There are indeed many foresters today who, if they were assured a reasonable hope of prevailing against the popular support of the Forest Preserve as wild land, would urge its selective cutting. The zoning of wilderness is unfortunately not yet as firm and as firmly accepted throughout our body politic as it should be.

Nevertheless, the manner in which the American people are appropriating for their leadership both conservationists and preservationists is at least somewhat encouraging for those who see the unity of this movement. This democratic way of dealing with apparently rival pleaders for the public interest seems strikingly evident in the two recently published books: *Forests and Men* by William B. Greeley, and *Steve Mather of the National Parks* by Robert Shankland. Mr. Greeley, an early follower of Gifford Pinchot, and a successor of Mr. Pinchot as head of the U. S. Forest Service, writes reminiscently of his career and of his observations and knowledge of American forestry. Mr. Shankland, in a thorough and competent biography that is a book not only for prompt and interesting reading but an historically significant work that belongs on the reference shelf as well, celebrates the accomplishments and the superb public service of the wealthy industrialist who made effective through the National Park Service the preservation of the national parks that John Muir so fervently advocated. In Mr. Greeley's volume we have a taste of forestry with the fervor of an evangelist, and in Mr. Shankland's we see Stephen Mather making a practical reality of the national park ideal. When Mr. Mather criticised the way the national parks were being run, Secretary of the Interior Franklin K. Lane, an old college chum, replied: "Dear Steve, if you don't like the way the national parks are being run, come on down to Washington and run them yourself." The inspiring and confident manner in which Stephen Mather accepted and met this challenge, and the experience of the National Park Service under his leadership and his still-continuing influence, are the subjects of Mr. Shankland's work. Mr. Greeley went from the public service on into industry, and there has sought to lead forestry into the ways of conservation and to help guide private enterprise into the self-discipline that it is hoped will make unnecessary or less rigid the social controls that his colleagues in the public service have advocated. Reading these two works and living in them the lives and experiences of these leaders in the second generation of Twentieth Century American conservationists, is both interesting and informative.

For the lay reader *Steve Mather of the National Parks* is a great American success story, one that will arouse a great pride in our parks and in the men who have established them, and who have designed and contrived means for preserving them and making them useful to so many people. For those concerned in any special way with conservation and the preservation of the na-

How Often I Have Turned

By ISABELLE BRYANS LONGFELLOW

Prairies have always awed me more than mountains.
It is the flow of nothingness into nothing —
Infinity unrolling from my very feet,
My eyes following emptily to no end.
But mountains are finite; you can use a mountain
For a sounding board to throw a thought against,
And a mountain will block you before you reach the rim.
How often I have turned from the eternity of prairies
To the nowness of peaks; how often I have fled
That blank, impersonal stare to shelter my eyes
In the perpendicular distance of a wall of mountains,
Rimming my day with rock.

tional park system this is an essential work, rich in its discussions of specific problems, such as those concerned with concessions, for example.

Mr. Greeley's index does not include the words "parks," or "national parks," or "wilderness," yet he writes in one place (and seemingly with pride): "Seven million acres in the national parks and monuments are devoted to the preservation of natural beauty and reserved from any form of commercial use." And in another connection he writes: "About half of Uncle Sam's wooded domain covers mountains too rugged and hills or mesas too sparsely timbered to be included as yet in our inventoried woodpile. These great stretches of the out of doors have, of course, many other highly necessary social and economic services. They protect water sources, conserve topsoils, and provide range for both game animals and domestic livestock. They keep for the oncoming generations something of the great inspiring and recreating hinterland that has contributed so much to American character and resourcefulness." His chapter "Our Public Forests," from which both these quotations are derived, is an excellent compendium of information. So is his entire book. Aside from its worth as reminiscence and as a sharing of experience, it has a real value in its gathering together of information. Its opposition to federal regulation of timber cutting on private lands will commend it to some and condemn it for others, yet withal it would seem that Mr. Greeley's zeal to convert his lumbermen to conservationists before the policeman have to be called in, is most commendable. If society's threat of controls can bring about a volunteer compliance, with the principles of conservation, perhaps thus has been revealed a most effective means of control, and we shall again have demonstrated a virtue of our democracy.

For many readers a most significant aspect of Mr. Greeley's work will be its attention not only to national and state, but also to county and local forests, and not only to the commodity but to the spiritual values of these forests.

"Wholly apart from wood and water," writes Mr. Greeley, "the town and village forests offer great spiritual values to the people of America. They have many subtle ways of allaying the stresses of life and reawakening its aspirations. The most recently dedicated community forest, at Shannondale, Missouri, was acquired through the joint sponsorship of community churches. The St. Louis *Post Dispatch* explains the project as designed 'to see what happens when the people of the community, working together, regard the hills, the trees, the valleys as gifts of God.' "

Bernhard Eduard Fernow: A Story of North American Forestry. By Andrew Denny Rodgers III. Princeton, N. J.: Princeton University Press. 1951. 623 pp. (6¼ x 9½ in.), with frontispiece photograph of Fernow, 5 other photographs on 1 plate, and index. $7.50.

Forests and Men. By William B. Greeley. Garden City, N. Y.: Doubleday and Co., Inc. 1951. 255 pp. (5½ by 8½ in.) with foreword by James Stevens and index. $3.

Steve Mather of the National Parks. By Robert Shankland. New York: Alfred A. Knopf. 1951. xii+326+xxii pp. (5¾ by 8⅛ in.) with introduction by Gilbert Grosvenor, 24 photographs on 24 plates, map, list (with acreage) of areas in the National Park System in 1915, 1929, and 1951, bibliography, and index. $4.

Shell Guide

A Field Guide to the Shells of Our Atlantic and Gulf Coasts. By Percy A. Morris. Boston. 1951. Houghton Mifflin Company. New, revised and enlarged edition. 236 pages. Illustrated in color and black and white. $3.75.

With more than 400 illustrations, 102 of them in full color, this is the standard guide to identification of the shells of our Atlantic and Gulf coasts. It is another in the Roger Tory Peterson Field Guide Series, and this revised edition includes 112 species of mollusks not covered in the first edition. There are new plates and revised plates, and much of the text has been rewritten, reflecting the comments aroused by the first publication of this fine guide.

World Nature Protection

The Position of Nature Protection Throughout the World in 1950. Brussels, Belgium. 1951. International Union for the Protection of Nature, 42, rue Montoyer. 538 pages. $4.00.

With the assistance of UNESCO, the International Union for the Protection of Nature undertook an extensive inquiry into the present status of nature protection on a world basis. Seventy countries responded to the request for information, resulting in this present valuable volume. While, of course, there are some gaps, the compilation provides a fine and much-needed basis upon which to build further world data. A great wealth of information has been assembled, making the book an invaluable conservation reference work, despite its lack of an index.

Guide to Oregon

Scenic Guide to Oregon. By Weldon F. Heald. Susanville, California, Box 288. 1951. Scenic Guides. 100 pages. Illustrated. $1.50.

Oregon boasts a generous supply of scenic wonders and this is a concise and usable guide to these outstanding areas. The descriptive and directional text is supplemented by photographs and by maps. The booklet is one of a series, guides to California, Arizona, Utah and New Mexico having already been published all at the same price of $1.50.

NATURE MAGAZINE

PUBLISHED BY THE AMERICAN NATURE ASSOCIATION

To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great Natural Resources of America

IN THIS ISSUE

November, 1951 Vol. 44, No. 9

NATURE MAGAZINE is published monthly, October to May, inclusive, bimonthly, June to September, inclusive, by the American Nature Association. Entered as second-class matter May 31, 1927, at the post office at Washington, D. C., U. S. A., and accepted for mailing purposes at the special flat rate of postage provided for in the United States Postal Act of October 3, 1917, and February 28, 1925. $4 a year; foreign, $5.00. Additional entry Easton, Pa.

Publication and Editorial Office, 1214 16th Street, N. W., Washington 6, D. C. Additional office of publication, Easton, Pa.

Mesa Flowers

Flowers of the Southwest Mesas. By Pauline M. Patraw. Santa Fe, New Mexico. 1951. Southwestern Monuments Association. 112 pages. Illustrated by Jeanne R. Janish. $1.00.

This is a companion publication to *Flowers of the Southwest Deserts*, and, together, they give splendid coverage of southwestern plants, except for those in the higher mountain zones, which are to be covered in a later publication. More than 180 species are covered in each book, and the text is useful to the average layman.

New Edition

The Physical Sciences. By Emmett James Cable, Robert Ward Getchell and William Henry Kadesch, with astronomy chapters by Harry E. Crull. New York. 1951. Prentice-Hall, Inc. Third Edition. 497 pages. Illustrated. $7.35.

This book, as with earlier editions, is directed to two general audiences. One comprises the college freshman who is preparing to teach. The other includes individuals who feel the need of an intelligent acquaintance with the various sciences but cannot devote time to foundation courses in the separate fields. Many changes have been made in this latest edition.

Man among Animals

Man and the Animal World. By Bernal R. Weimer. New York. 1951. John Wiley and Sons. 569 Pages. Illustrated. $5.00.

Approaching the unknown from the known, Dr. Weimer in this textbook "attempts to treat the organisms of the animal world as dynamic living entities, manifesting in various ways the fundamental life phenomena common to all living animals." Since man is the one living animal that the student knows best, man serves as the logical approach to the life principles and processes found in other animals. The text is written for undergraduate students in college and does not rehash the high school biology course.

Know the Weeds

Weed Seedlings. By Anna P. Kummer. Chicago. 1951. The University of Chicago Press. 435 pages. Illustrated. $5.00.

Even more experienced gardeners have, on occasion, nurtured plants that had interesting potentialities but turned out to be weeds. Eliminating unwelcome intruders from garden, farm, ranch or woods often is the result of learning, the hard way, which is weed and which is not. Now comes Mrs. Kummer with a book that covers some three hundred broad-leaved weeds and how to identify them. This is a most useful book.

Finding the Birds

A Guide to Bird Finding, East of the Mississippi. By Olin Sewall Pettingill, Jr. New York. 1951. Oxford University Press. 659 pages. Illustrated by George Miksch Sutton. $4.00.

This is a travel guide to birddom in twenty-six States by an ornithologist whose long experience in the field has provided him with the rich material for this helpful and unique book. He tells the bird enthusiasts where the birds they want to see may be found, when they may best be observed, how to get where they are, where to stay on a bird-seeking expedition, and he provides other valuable information. Also included is information on sanctuaries, camps, museums and other agencies that will round out such an experience. Habitats covered range from seashore to mountain top, and the data are also supplied on a seasonal basis. This is a splendid and useful addition to any ornithological library and a must for the peregrinating bird student.

Western Pacific Trees

Trees of the Western Pacific Region. By J. Hugo Kraemer. Cincinnati. 1951. Tri-State Offset Co., 817 Main St., Cincinnati 2, Ohio. 436 pages. Illustrated. $5.50.

The material for this book was originally assembled during World War II for the use of the armed forces, which needed to know the trees they encountered in the Western Pacific region. The information is now made generally available, and covers trees found at low elevations, near beaches and along water courses. The trees covered are widely distributed throughout the region. With our concern so largely in the western Pacific, this is a most valuable contribution to a knowledge of one of the important resources of the region. The author is Associate in Forestry at the Agricultural Experiment Station of Purdue University.

Naturalists' Directory

Announcement is made by Herman E. Cassino, Salem, Massachusetts, of the publication of the 36th edition of the *Naturalists's Directory*, first published in 1878. It carries lists of naturalists, and their interests, by States, and lists of natural history museums and scientific periodicals. It sells for $3.50.

Alaskan Science

Proceedings of the Alaskan Science Conference. Washington, D.C. 1951. National Research Council. 216 pages. $2.00.

The Alaskan Science Conference was held in the national capital in November, 1950, under the auspices of the National Academy of Sciences-National Research Council. Its objects were to stimulate wider interest in research relating to the Alaskan area and to explore ways and means by which those who are engaged in field research in Alaska can be of greater assistance to each other and of value to future research. Therefore these published proceedings bring within covers a wealth of material about Alaska. This book is most valuable as a source of reference on the Territory.

Briefly Listed

Guide to the John Muir Trail and the High Sierra Region. By Walter A. Starr, Jr. San Francisco. 1951. The Sierra Club. 130 pages, with end map. $2.00.

This is the fourth edition of this excellent guide to the area indicated in the title.

Tidewater to Timberline. By Dan McCowan. New York. 1951. The Macmillan Company. 205 pages. Illustrated. $3.75.

A collection of animal stories by the well-known Canadian naturalist-writer.

Man and the Living World. By E. E. Stanford. New York. 1951. The Macmillan Company. 863 pages. Illustrated. $5.50.

This is a second edition of this comprehensive textbook for use in elementary biology courses.

The Apple that Jack Ate. By William R. Scott. New York. 1951. William R. Scott, Inc. Illustrated by Charles G. Shaw. $1.50.

A picture story, with brief text, that tells how the apple that Jack ate came to develop into an apple.

You among the Stars. By Herman and Nina Schneider. New York. 1951. William R. Scott, Inc. Illustrated by Symeon Shimin. $2.25.

A quite elementary introduction to the heavens for youngsters, but one that may well stimulate later interest.

The Wise Fisherman's Encyclopedia. Edited by A. J. McClane. New York. 1951. Wm. H. Wise and Co. 1336 pages. Illustrated.

This is an amazingly complete encyclopedic handbook for fishermen, covering the game fish of the world and how to catch them.

Born to Battle. By S. Omar Barker. Albuquerque, New Mexico. 1951. University of New Mexico Press. 187 pages. $4.00.

A collection of fourteen short stories of western animals by an outdoorsman and writer who knows intimately the animals about which he writes and the country in which the characters in his stories roam.

The Lost Pharaohs. By Leonard Cottrell. New York. 1951. Philosophical Library. 256 pages. Illustrated. $6.00.

This is a book for the amateur by an amateur telling the story of the romance of Egyptian archaeology.

Physiology of the Fungi. By Virgil Greene Lilly and Horace L. Barnett. New York. 1951. McGraw-Hill Book Company. 464 pages. Illustrated. $7.50.

A textbook and reference volume discussing the living fungi, their life processes and the factors or conditions that influence these activities. The book accumulates and coordinates the present information on the physiological aspects of growth, methods of cultivating fungi, reproduction, parasitism and variation.

Ecological Animal Geography. By W. C. Allee and Karl P. Schmidt. New York. 1951. John Wiley and Sons. 715 pages. Illustrated $9.50.

This is a revised and second edition of this important volume based upon the work of Richard Hesse. Terminology has been simplified, bibliographies expanded, and much revision included. The book has been given wider application on a world basis from the conservation viewpoint.

Feathers Preferred. By W. Austin Peters. Harrisburg, Pa. 1951. The Stackpole Company. 198 pages. $3.75.

Subtitled "A Sportsman's Soliloquy," this book presents a sportsman's view of the impact of the gun on game bird populations.

Brought to Cover. By Paul Annixter. New York. 1951. A. A. Wyn. 247 pages. $2.75.

A collection of outdoor stories by a well-known writer in this field.

A Boy and His Gun. By E. C. Janes. New York. 1951. A. S. Barnes and Company. 207 pages. $3.50.

A guide to safe use of sporting arms and an introduction to sport shooting for boys.

The Restless Universe. By Max Born. New York. 1951. Dover Publications. 315 pages. Illustrated. $3.95.

This is a second and revised edition of a book in which the author explores many mysteries of the universe, making modern physics intelligible to the layman.

The Way of a Fox. By Douglas St. Leger-Gordon. New York. 1951. The Macmillan Company. 192 pages. Illustrated. $2.25.

A story of the fox in England, its life, habits, and characteristics. Sympathetic and well written.

How to Know the American Mammals. By Ivan T. Sanderson. New York. 1951. The New American Library. 164 pages. Illustrated, and with end drawings of tracks. $.35.

This is a Mentor book providing a popular introduction to North American mammals. Trade edition to be published by Little, Brown and Company.

Contents Noted

ACCORDING to a U.S. Public Health Service epidemiologist in Colorado, magpies and redwing blackbirds have been found to carry the virus of encephalitis, or sleeping sickness. The birds, he says, do not suffer from the virus, but mosquitoes pick it up from the birds and transmit it to man. Just how the mosquitoes bite the birds through their coat of feathers, the doctor does not say, and whether he has any evidence that mosquitoes bite birds anyway is not indicated. We are in no position to dispute the epidemiologist's findings, but unless his conclusions are based upon far more evidence than seems apparent and a wider zoological knowledge than seems to be indicated, his statement, in our opinion, is frivolous. It may well lead to organized programs to shoot all magpies and redwing blackbirds for sport, and, along with them, many other species of birds. We do not suppose that it ever occurred to the doctor that the birds might have eaten mosquitoes already infected from some other source. As one of the many readers who have called this matter to our attention puts it — "of all the malarky!"

ONE OF our members in Indiana reports that "our public service folks" came around in June and trimmed trees. The result was the wholesale destruction of many bird nests and young birds. Our member states that, to her certain knowledge, nests of robins, cardinals, catbirds, wrens, creepers, song sparrows and others were thus destroyed. Such ill-timed tree-trimming is difficult to understand and must be based upon either thoughtlessness or downright ignorance. We hope that this is only an isolated case, but if it is at all general State conservation departments and Audubon groups have an educational task to perform.

IT FREQUENTLY looks as though the U.S. Bureau of Reclamation enjoys making enemies. In any case, it seems increasingly to ignore local needs, rights and humanity in favor of grandiose and costly schemes imposed with Hitlerian gestures. A case in point is in Pitkin County, Colorado, where the citizenry has organized to prevent the diversion of water from the western slope of the Rockies to the eastern slope through a scheme that is scheduled to cost nearly $150,000,000, and almost certainly will wind up by costing a lot more. Aspen, Colorado, is felt to be doomed, with the construction of a dam on a sand foundation only a mile above the city. The citizens, speaking through the Pitkin County Water Protection Association, point out that the recently dedicated Granby Dam is already leaking, although only one quarter full of water, and must be repaired at a cost of one-third its original cost. If this sort of thing keeps on the Bureau is likely to "dig its own grave," but there will be a lot of waste and destruction before the interment takes place.

WHERE they came from is unknown, but nine years ago an expectant Japanese Sika deer and two young appeared on the farm of E. B. Ferguson near Hilton, New York. Bill Ringle reports, in the *Rochester Times-Union*, that the farmer, who extended a welcome, is now the host to a herd of 24 of these little deer. They enjoy the hospitality of three acres of meadowland and woodland. There have been thirty-seven of the deer in all since the first arrivals. They are tame and regard the Ferguson farm as home. The farmer tried for some time to discover whether the Japanese deer had escaped from some private preserve, but could find out nothing and finally gave up and went right on being host.

MIGRATORY waterfowl hunting rules, under which the ducks and geese are now being shot, were liberalized this year in varying degrees depending upon prospects for more birds in the different flyways that they traditionally follow. Breeding conditions to the north were reported by surveys to have been generally favorable, and to have resulted in substantial increases in the numbers of migratory waterfowl. We will have to take the word of the Fish and Wildlife Service for this, since that agency is responsible for the regulations and the maintenance of the numbers of these birds. The Service frequently professes great concern about the large annual losses through crippling. In view of this it is difficult to reconcile its persistence in allowing shooting to start one-half hour before sunrise. If there is any shooting period that causes loss through crippling it is that period.

TWENTY years ago the trumpeter swan seemed doomed to join the list of extirpated American birds. In 1935 only seventy-three of these birds, which once ranged widely over the West and mid-West, remained. Then a refuge — Red Rock Lakes Refuge — was established near Yellowstone National Park, within which some of the birds are also resident. Yearly since then, a census of the birds has been taken and the annual count this year reveals 535 trumpeters. This is an increase of 159 adult and young swans, or cygnets. This is the largest increase in numbers in any year since the strict protection of the birds was put into effect. Some of the birds have been moved to other protected areas and are thriving.

A REAL contribution to conservation and to public education is being made by the Allis-Chalmers Manufacturing Company through arresting advertising of its tractors against a background of destructive forest fires. These are called "Public Waste No. 1," and the text of the advertisement points up the losses in timber, soil and wildlife caused by the scourge of fire. This sort of advertising could be a suggestion to other American industries, dependent upon the protection and wise use of our natural resources, that the conservation appeal would properly be a part of their message to Americans. R.W.W.

The sensitive eyes of the screech owl both are directly frontal, for the bird has few enemies to fear from behind. Owls' eyes are supported by a bony structure, the sclerotic ring, and will not turn in the sockets.

EYES — Clues to Life Habits

★
★
★

By PAUL SHEPARD, JR

Photographs by Richard B. Fischer

IF SOMEONE were to put into your hands an animal that you had never seen before and ask you to describe its behavior in the wild, what about it would provide you with ideas?

One of the best organs to examine for clues to the animal's activity would be the eyes. Written in them is the story of the creature's life. And they are also the diary of its racial history, of the habits, food sources and fears born of the ancestral experience of its kind. The eye is the soul's window — yes. But it is cast in a mold fashioned by particular habits from universal material.

Among vertebrates, the fishes developed the first good eyes, by our standards. These underwater eyes were nearly all alike, in many respects. However, when a land environment was adopted in the process of evolution, eyes became as divergent as the demands upon them.

Some eyes were sharpened to perfection by natural selection, only to become debased and feeble through the vicissitudes of geologic time. The fish eye reached an evolutionary end because sight under water is limited. Snakes took their fine reptilian eyes beneath the ground, and nocturnal mammals wasted them in the darkness of night. When the descendants of these animals once again moved into the daylight they were handicapped, and the eye was re-molded.

What were the forces of this mold? What has it meant to the eye that some creatures must escape in order to live, while others must capture? Why does the rat see only shadows, while the hawk watches a grasshopper a half-mile away? Why do some animals see color and others do not?

In the beginning, ocular raw materials were much the same among all vertebrates, but life has since demanded many modifications, and these in comparatively short periods of geological time. If we assume that a "better" eye is one that resolves an image into greater detail, then a strange classification has come into existence. The development of good sight is not in accord with our system of systematics. "Higher" and "lower" groups, each, have all sorts of eyes. The magnificent eyes of birds are belittled by the inadequate ones of the kiwi, and the blurry vision of mammals is honored in the good eyes of man himself. The reptiles, amphibians, and birds also harbor their paragons of vision and the opposite.

Among various kinds of animals, visual efficiency is in proportion to the importance of sight to the animal's existence. A golden eagle hunting an antelope relies on acute vision. The antelope, too, is a creature of much daylight activity, and is often dependent on keen sight. But the antelope may also *smell* the coyote that stalks it. The coyote may put eyes, nose, and a superior intelligence to work in stalking an antelope, stealing poultry, eating sheep and carrion, or digging up rodents such as the pocket gopher. To elude the coyote, the gopher depends only on tactile and hearing senses. To the gopher, sight has little or no survival value. This animal is at the bottom of the visual scale, the eagle at the top.

Animals at the top of the visual ladder — predator or prey, fish or furbearer — have large eyes; not large in proportion to their heads or bodies, but in absolute

The cat is a perfect predator. It can operate in either daylight or darkness because its large, sensitive eyes are protected in bright light by a pupil that closes to a tiny slit.

The eyes of the painted turtle are canted downward because it is protected from above by its shell and must scan the bottom continually for food.

size. This is because the seeing cells of the eye, which receive an image on the retina, are all about the same size, whether in bobcat or bison. A big eye is important then; it holds more such cells, which break down the picture into greater detail. The big eye also increases the distance between the lens and retina, throwing a bigger image on the living screen.

Bright light enables an object to be seen better and at greater distance. Thus, the best eyes belong to animals of daytime and *must* have daylight to function well. To most temperate zone reptiles, sunlight is the great motivator. What use are eyes that see in the "dark" when nights are spent in immobility? Many mammals, and some birds and amphibians, have developed an eye that works fairly well either in daylight or night. Some creatures' eyes shine in the dark, but the eyeshine is nothing more than a reflective material that helps make the most of whatever light strikes the retina. In daylight some of these animals cover this material in a manner similar to closing Venetian blinds.

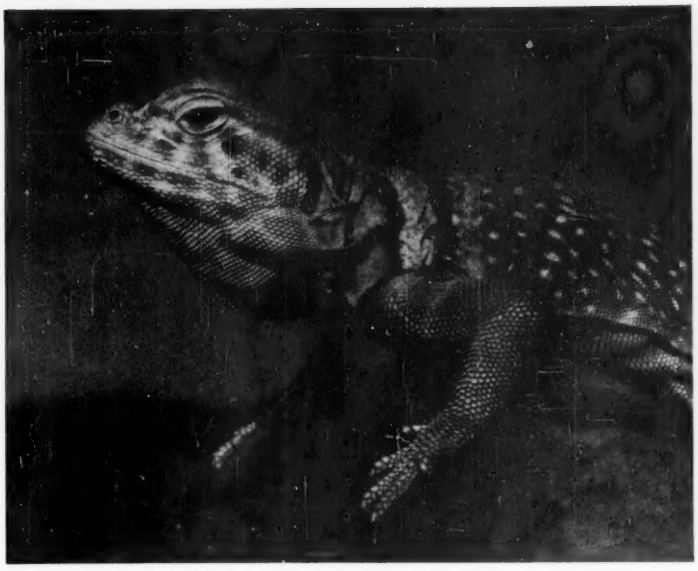
Generally, nocturnal animals depend on other senses than eyesight; have poor eyes. Some find it necessary to see, like the owls, and develop exceedingly sensitive eyes. Most mammals are nocturnal, probably because their ancestors were hunted down in the daylight. It is mostly warm blooded creatures that seek the cover of darkness for protection, like the mice who efficiently scavenge our kitchens. Early mammals inherited keen vision from their reptilian ancestry — good eyes like those of today's lizards. But in millions of years of "sneak" existence in the dark the eyes degenerated, as is shown by any mole or shrew.

Predators generally have greater stamina, quicker reflexes, or move more rapidly than their prey. High mobility requires good ocular resolving power and rapid focusing to avoid collisions. The size of an animal's eyes is directly proportional to its speed. Without bigger eyes the bass and trout, for example, might be relegated to the food habits of carp and catfish.

Fast-moving animals also need quick adaptation to changes in light intensities. A powerfully muscled iris (which stops down the pupil) provides extensive dilation and contraction for just such reasons. Cats see well in the "dark," but also enjoy sun bathing. This luxury would be impossible without an iris muscle that contracts to a tiny slit and protects the sensitive retina in strong light. A Cooper's hawk, darting from the dark woods into a sunlit clearing where sparrows feed, or out of the midday sky to capture a flicker on the forest floor, flies through drastic changes of light intensity. The same is true of a sea lion diving for squid or fish. Hawk and sea lion are equipped with a flexible iris.

Accurate and immediate estimation of distance is also important to a predator. The striking snake, leaping tiger, or diving falcon must judge quickly. Binocularity, or placement of the eyes in the head so that they can be focused on a single object simultaneously, makes such judgment possible. This placement — *frontality* — is characteristic of the predator anatomy. Prey species, on the other hand, have lateral eyes, each with its own field of vision. Many occasional predators, who both hunt and are hunted, fall between the two extremes. Their oblique eyes compromise the values of binocularity with the advantage of a wide visual field.

Every animal falls into this picture somewhere. The cottontail rabbit, a prey species, does not see the grass it eats. *Binocularly* it sees only a few degrees in front and rear — where it may need distance estimation to dodge an immediate pursuer. But with one eye on a side, the rabbit has a total, lateral, visual field of 360 degrees. Nor can an enemy approach unseen from above, as the rabbit also sees up without moving its head. Opossum eyes are a compromise. The opossum may capture a small invertebrate one moment and scurry up a tree for its life the next. The cottontail's eyes are 90 degrees off the body axis, the opossum's are 30 degrees off. The lynx, with few ene-



The collared lizard lives by its keen vision. Most of the lizards enjoy visual acuity probably superior to that of man and can move each eye separately.

mies to fear, and stalking proficiency imperative, is totally frontal, with eyes in the body line.

Eyes also become dorsal or ventral. The woodcock, probing in the mud for larvae, watches the surrounding undergrowth with large eyes, far back on the head. Although a predator as it feeds, the woodcock has little need of seeing the mud its long bill explores. The turtles, eminently successful through the ages, have little to fear from above. Their eyes are almost frontal and canted downward to scan the bottom for food.

It should be noted that frontality may have other values than for predation. The eyes of primates are frontal presumably because of close-up use of the hands and the tree-swinging habit.

The perception of motion is a complex part of seeing, but one aspect is of special interest regarding food habits. It has been asked how a hawk, sitting in a dead tree, can spot a mouse moving anywhere in the field — unless he happens to be looking right toward it. The registration of movement on the retina is exaggerated around the boundaries of the visual field, as though to compensate for not "looking that way." This seems to be especially true of the lateral periphery. You can demonstrate this for yourself when you are a passenger in an automobile by tipping your head horizontially and watching the road ahead; it seems to rush beneath the car at increased speed.

The value of color vision and its corollary, protective coloration, is a popular topic for debate. Color vision is scattered about the tree of life, without certain connection to predation. But the only groups that use sight *exclusively* for food-getting seem to possess it throughout, as with the birds and lizards. It is also found in the turtles, higher fishes, and the primates. The contrast value of color is obvious. What if all your books were one color! It would seem valuable to a predator that must discern its prey. Yet, protective coloration seems to compensate for the increased vulnerability of the hunted animal — which, in many cases, does not see color itself. If such coloration were completely successful it would appear to make color vision in the predator a liability — witness the success of "color blind" artillery observers who spotted camouflaged installations from the air. Probably, the two forces, like the "balance of nature," are never quite in adjustment.

The hawks, like this sparrow hawk, seem to have the keenest vision in the world, about eight times as good as that of man.

Predation and habitat have interworked to produce combinations of eye characteristics. Most of the organ's evolution was completed by the time vertebrates came on land. The terrestrial environment superposed modifications on an organ fashioned under water,

in an extremely different set of conditions. The higher fishes have superlative eyes, but the development of aquatic vision is limited by the medium itself. Visibility has a range of about 150 feet in the clearest water, and no change in the eye can alter this. In fish, the lens does all the focusing and the cornea serves only as a protective window. The cornea's refractive index is the same as that of water, so that light rays pass directly through it. But not so in the air. Rays entering the eye bend once at the cornea and again at the lens, enabling the terrestrial eye to develop a small, efficient lens. The bulky, spherical lens of the fish bumps against the cornea as far forward as possible, to attain a wide visual angle. It protrudes through the pupil, blocking its contraction. This, as we have seen, puts a limit on light toleration. Only a few fishes, such as sharks, have pupil mobility of the sort that makes cats and seals independent of day and night.

Many animals that feed or live in the water are faced with the necessity of seeing well in air, too. Without compensation, their air eyes are sadly farsighted under water, for the cornea is no longer refractive. The problem is met in four ways.

Aquatic birds utilize the nictitating membrane when diving. It is a thin, third eyelid, underlying the regular eyelids, and found in all birds. In the diving ducks the membrane has a clear window of highly refractive material. A canvasback, diving for submerged plants, closes the third eyelid to bring the food into focus. The loons and auks share this device with the ducks. It is supplemented by a powerful iris muscle.

In many creatures a strong iris muscle constitutes the sole means of focusing under water. It is attached to the lens so that, when it contracts, the lens is squeezed out of shape and into focus. The turtles, otters, and cormorants have these soft lenses in the grip of a vigorous iris muscle. This lens-squeezing is typical of all reptiles (except snakes) and birds, although greatly accentuated in the divers. Early in their history the mammals lost this efficient method of accommodation, or focusing. It was one of the penalties for night-prowling. Their iris muscle gradually withdrew from the lens, degenerated, and was replaced by zonular fibers, which guy but do not squeeze the lens. Under this handicap, our limited focusing is based on the elasticity of the lens and contraction of the zonular fibers.

The kingfisher, and at least one fish, show us a third way for air eyes to see under water. The kingfisher possesses two foveal areas, or areas of keen sight where the image is focused on the retina. They are different distances from the lens. The more nasal of the two is closest to the lens and receives the image when the bird is in the air, and the cornea refracting. When the bird plunges into the water for a fish, the focal point shifts to the temporal, or more distant fovea, bringing the prey into focus once more.

A minnow of the genus *Anableps* utilizes both areas of keen vision at one time, as the fish drifts along the quiet surface of brackish waters. The iris is so shaped that the pupil is cut into a dorsal and ventral half, the former riding out of the water and the latter beneath the surface. Images in the air are received through the dorsal pupil on the ventral half of the retina, and objects below the surface are seen through the ventral pupil by the upper part of the retina.

The fourth mechanism is simply a highly mobile pupil, which can be closed to a tiny pin-point in the daylight. The "depth of focus" is thereby increased, giving a clear picture at all distances like the old-time box camera. Under water, the dilated pupils of seals, sea-lions, and walruses focus normally on the retina. In the air, or in bright light, the tiny pupil compensates for the additional refraction of the cornea, and the animal sees fairly well.

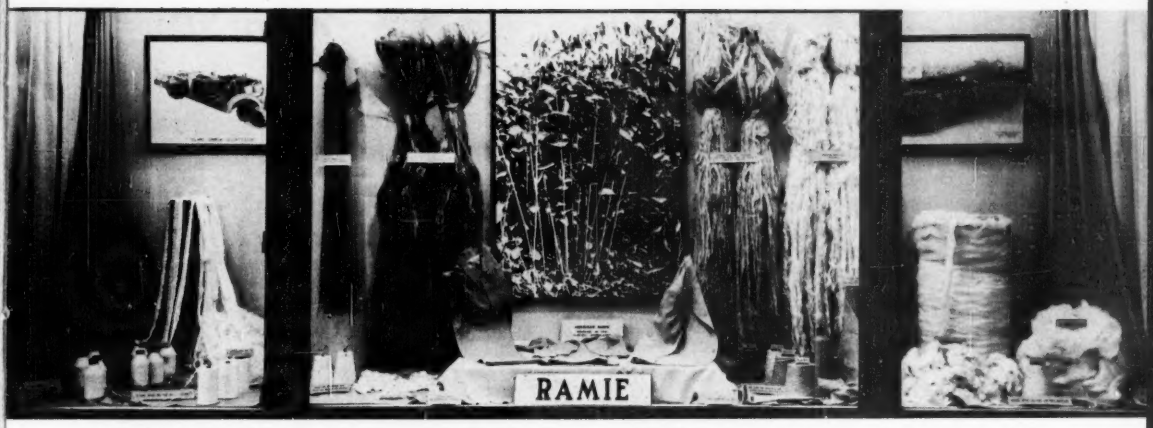
Some vertebrates, like frogs and crocodiles, inhabit both media but see well only in one. These two groups are hopelessly farsighted under water but see well in the air. The penguins, on the other hand, see well under water but are nearsighted in the air.

Another problem faces animals that must see well into one medium from the other. A fish, looking into the air at a fly, like the osprey looking down at a fish, must overcome the confusion of bending light rays. Their prey is not where it seems to be for the same reason that a stick that you poke into the water seems to bend. The discrepancy in the apparent location of the osprey's intended victim is obvious to anyone who has tried to shoot fish with a rifle.

The fish, as it looks out of the water at an angle, faces a problem involving trigonometry and the refractive indices of both media. Moreover, the angle subtended by the surface of the water over a fish, through which it can see, is about 97 degrees. Outside that angle the fish sees nothing but the reflected bottom. Crammed through that 97-degree window is the whole bowl of the sky, from shoreline to shoreline. The error involved in determining position has a sliding value according to the object's relative position above the fish. Only a fly directly over the fish is seen in its true position, and the same is true of a fish below an osprey. Probably both must strike from directly below or above to make a successful catch. The value of mobility is again emphasized in predation — and the eyes to go with it.

An extreme example of the problem is faced by the archer fish, a South American perch that shoots a jet of water from its mouth, knocking insects from shore vegetation or emergent weeds. The fish's eyes are under water, its mouth above. The shot is usually at an angle. If the surface of the water is choppy, the problem becomes even more complicated, and would seem almost impossible if the wind sways the weed bearing the prey.

When we consider all of these factors related to eyes and seeing, we come to have a deep regard for Nature's ingenuity in providing her creatures with eyes for various special needs, that they may survive.



An exhibit showing the various stages of ramie, from raw fibre to yarn, and the variety of products that can be manufactured from this ancient-yet-new fiber plant.

Ramie, Ancient and Versatile Fiber

By JENNIE E. HARRIS

Photographs from Sea Island Mills, Inc.

FROM a broad canvas of green in the Florida Everglades, men are snipping out wrappings for the drive-shafts of our battleships — or at least they will become wrappings after intervening processes.

The urgency began during War II, when a shortage of many kinds of fiber developed. Someone suggested ramie to our Navy authorities.

"Ramie! Are you kidding?" came the response. "We can't get ramie from China now; Japan sees to that."

"Florida's growing ramie."

Since the 1860s, there has been experiment in Florida with ramie, a nettle hand-worked in China for 5000 years, and long recognized as the sturdiest fiber grown.

The plant likes warm, wet soil where it can soak up quantities of water. It also likes the prolonged warmth that Florida offers. Floridians had found the growing easy. Sixty-five to seventy days after planting, dense masses of ramie with luxuriant dark green leaves were six to seven feet tall, ready to be stripped of their fiber. But here arose a stumbling-block. "How can we strip the stuff?"

In China, peasants do the stripping with their skilled, overworked thumbnails. In fact, China's way with ramie is the ancient way of endless patience. As soon as the stalks bloom and turn brown at their base, the Chinese cut them to the ground, strip off the leaves, carry sheaves to the river, beat them with wooden hammers against wooden blocks placed under water. "*Plock, plock,*" — they soften the lengths. "*Plock, plock,*" — they pestle out what gums they can, until what is left is slick fiber suitable for a variety of uses.

For many centuries the Chinese have hand-woven garments from the fibers yielded by this sturdy nettle. The short loose coat the Chinese fisherboy wears may be the same coat his father wore when he was a boy, and his grandfather before him. It seems never to wear out, emerges fresh and unshrunken each time it is dipped into the family pool. The net the boy fishes with may also be his grandfather's, and woven also of water-resistant ramie.

China utilizes tons of ramie each year for her own varied needs, and ships tons away; or did, before Communist control.

This raw, partially degummed, imported ramie fiber is known commercially as "China grass." It is woven in France into art "linens" and silk substitutes; into tough bank-notes. It is spun in Switzerland into lustrous cloth for clothes. It is processed by our New England mills into beauty and sheen, to add quality to other fabrics. We imported ramie altar-cloths from China. Often Japanese mulberry silk fabrics contained ramie for extra luster and strength.

But the problem was where in Florida were there any Chinese thumbs? Or where was the labor to compete with Chinese who earn scarcely enough in China to buy a handful of lotus seeds?

State experiment stations, working with ramie in Florida and south Atlantic and Gulf States, as well as in California, were all experimenting with machine strippers and decorticators, to remove the bark. An economically feasible degumming method proved a challenging problem because the decorticated Chinese

Growing ramie. It grows to harvestable condition in sixty-five to seventy days, forming dense stands.

ribbons varied in quality.

Navy men tried wrapping some of Florida's ramie, degummed, braided and soaked with lubricants, around the drive-shafts of vessels. The stuff was found not to score the shafts and to last a long time. The Navy called for more.

Men disturbed the perennial quiet of the Everglades. They cut through the tall gold of saw grass, blades, tough as ramie stalks, with edges sharp and jagged. They disturbed haunts of alligators, crocodiles, of herons, ibises, and cranes. Wild myrtle, wild cucumber fell, as they prepared ancient soil for the growing of engine-packing.

They canalled, drained, ditched, plowed, treated even that rich almost solid humus with copper salts, muriate of potash, and other fertilizers. They subdrained, sub-irrigated. Then they planted ramie roots, each root cut into little pieces, each piece showing an eye.

Within seventy days, returning herons could rest on a dense mass of ramie, shouldering big green leaves. Yellow-white flowers already budded in leaf-axils; the lower parts of stalks already were browning.

Weeds had sprung up too, but men had slain weeds and ramie alike. Then the ramie sprang up way ahead of the weeds; soon shadowed them from existence. "Watch that stuff grow! It flings up almost as fast as bamboo! You can lose yourself in a stand of ramie; in a heaving sea of green. Heart-shaped leaves are darkly crowded on the stems, and when the wind flips them over, you see their white undersides. Down below the big leaves, and hoisting them high, are the strong, flexible stems, slender, swaying. Small leaves are attached along their lengths. Just beneath the outer bark of stem, between the center core of pith and the bark, lies the stuff that makes fiber — cellulose and crystals embedded in gums and pectins.

Some companies grew ramie for root-stock; others planted roots already available. Nathan Mayo, Commissioner of the Florida State Department of Agriculture, had enough root-stock on his Everglades farm at Belle Glade, begun with four acres of ramie, to plant 4000 acres. All growers concentrated on one variety of ramie, *Boehmeria nivea*, although travel, research, and correspondence with botanists had brought to light thirty kinds, mostly in the Far East. The cultivated kinds are found mainly in China and the Philippines.

Then inventors, engineers, devised a competent decorticator. Usually a reaper and a binder work on ramie in the field when it is at peak-growth, before its bark toughens. Leaves and tops fall, to maintain soil-fertility. Stalks enter the decorticator and come out as thin, shining, wet threads. These are far longer than cotton threads, and are ready for spinning, as soon as chemicals remove gums, pectins, waxes, and chlorophyll.

Haiti, South America, the Orient, knew fresh impetus with this successful decorticating. Inquirers overseas asked, "What is the percent of degumming? Can you ship us a decorticator?" Machines promised to do for ramie what the cotton gin did for cotton. Jock A. Murray wrote in the *Tampa Morning Tribune;* "One of these days a machine will be on its way to China to help emancipate an old and burdened civilization. That, indeed, will be 'oil for the lamps of China.' "

Our Navy used all the American output of ramie during World War II — about 72,000 pounds grown to an acre, out of which came about 2000 pounds of usable fiber per acre. The Navy again requires enormous amounts.

About four years ago, a sports coat fashioned by Stern Apparel of Cleveland, Ohio, hung in Burdine's window at Miami, Florida. It was a coat of "Siland," trademark for ramie grown and processed by Sea Island Mills, Inc. It was half ramie, half rayon; resembling fine tan homespun. It was the first coat made of ramie grown and processed in Florida.

Sea Island Mills, New York, leading integrated growers, decorticators, degummers, spinners, weavers and finishers of ramie, convert it into yarn for gas mantles, industrial belts, cloth for shirts, dresses, jackets, suits. Commissioner Mayo wears a suit made

of ramie grown at Belle Glade. "Lightest weight suit I ever wore. Ideal for Florida sunshine," he says.

"Wearing apparel from ramie," prophesied the late W. B. Granger, manager of the State farm at Belle Glade, "will be sheerer, more delicate than any yet made; lighter and stronger than any yet imagined."

Ramie has such a multiplicity of uses and possibilities that large investments are being made in the growing of this ancient-yet-new fiber. The plants yield not only engine packing, but surgical dressings, towels, upholstery, carpets, velvets, embroideries, ropes. They produce ramie filters for air-conditioning units, ramie belts for huge machines. And the wisp of handkerchief, dropped in the office elevator, may be of Everglades ramie.

England placed faith in ramie when Hitler's bombs burst water mains there. Flexible water mains of ramie, up to fourteen inches in diameter, were substituted. Used without a lining, they maintained water service without springing a single leak.

During the war, England converted 500,000 pounds of ramie yarn into fire hose, thousands more pounds into parachute cords. Strong as ramie is when dry, the wet strength is 60 to 100 percent greater, depending on the yarn and weave used. It becomes indispensable for use in many sorts of "rubber" goods; as ropes, liferafts, canvas, nets. It is highly resistant to mildew or water-rot.

For forty years the Yorkshire Ramie Spinning Co., Ltd. of Bradford, England, has been making ramie yarn for such varied purposes as damask, upholstery, velvets, shoe threads, fishing nets, dry batteries, brake linings, hammocks, fire hose, parachute cords, non-shrinking tropical suitings, hats, sponge-cloths, paper and other products. Ramie makes strong, beautiful high-grade writing and documentary papers, transparent or opaque. "We experimented with ramie fiber some time ago," writes Crane & Co., paper makers of Dalton, Massachusetts. "It makes a very satisfactory sheet of paper; is really comparable to a flax fiber." It also makes a superior cigaret paper and excellent carbon paper.

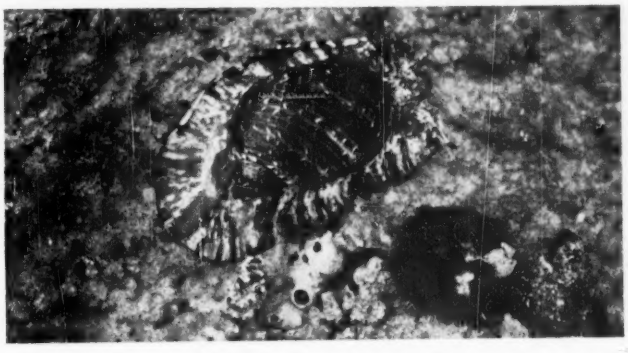
Ramie is not yet a major Florida crop. As the U. S. Department of Agriculture points out, its growth, processing and milling must all be considered as still in an experimental state, although this is a fiber diversely utilized when Rameses of Egypt ordered deities painted on a body's linen casing; when ancient Romans wore robes spun of ramie's glossy fleece!

"There is nothing mysterious about growing and degumming ramie," comments Harry Neiman, president of Sea Island Mills. "But you must have your mind on producing fiber, yarn, and goods, rather than on making money selling shares of stock."

In the Smithsonian Institution, Washington, D. C., a Sea Island Mills display shows ramie in various stages — from the growing plant to finished products.

"Whew," exclaimed a tourist viewing this display. "You make all those articles just from that one plant! There must be a catch somewhere."

Yet there seems to be no catch, unless we are just now catching up with ramie's past five thousand years.



This partridge tun was photographed on a beach on the Hawaiian island of Kauai, when the day was clear and the water still. The animal was in a gay mood and active, its tentacles extended. Its smooth, even and thickened lip is shown. The black, bun-like animal near the mollusk is a sea urchin, which thinks it is well hidden by the "cloak" of seaweed and coral attached to its spines.

Partridge Tun

By REBECCA E. BANKS

THE partridge tun, or *Tonna perdix*, is a mollusk that belongs to a fairly well represented group in Hawaii. It is widely distributed in the tropical seas of the Pacific Ocean.

This particular tun is one that has ventured into shallow water of less than ten feet, and can occasionally be collected on sandy beaches. Explorations into deeper water reveals large specimens in greater numbers. The tun is to be found on specific beaches on the island of Kauai and also on the island of Hawaii, while in other areas none is encountered.

The shell is hard and thin, with characteristic markings such as extreme smoothness, slight depression of the spire, thickened lip with no serrations. This particular tun is an active mollusk. While watching a live specimen one is often startled by the rapid movements. The animal is large and strong, with a muscular foot.

The shell collector is often disappointed with the tun shells because they fade with age. The new shells are beautiful, with the lateral lines of brown, white and tan, splashed with the cross lines of white or light tan. The shell is a "find," because it is thin and hard.

Seeing Bally Home

By DAVID F. COSTELLO

Illustrated by Barbara M. Castello

INWARDLY, every healthy man, woman, or child has some of the urge of the naturalist. For most of us, both physical and spiritual reward flows from regular contact with Nature. But for many people who can travel Nature's paths only intermittently, because of life's other demands, there is a feeling of incompleteness.

Unlike movie patrons, who see the full show, regardless of when they go in, most of us never see the full sequence of events in Nature. Partly through lack of time, but more often through lack of patience or failure to plan, we miss both the beginning and the end.

Much of this need not be so. We can piece together our experiences, even though they be simple, into scenarios that make Nature meaningful; enriching to mind and soul.

I recall a pleasant sequence that developed outside my office window. Three years in a row the robins built their nests level with my desk on the second floor. The first year, I returned from a long trip and only saw the nest when the babies were several days old. The second year, I saw the nest-building, the egg-laying, and some of the brooding. I missed all the feeding. The third year I saw only the end, the young birds learning to fly. There are still gaps in the story, but the sequence is almost complete.

One of my sequences has lasted more than thirty years. It started when I was a barefoot boy, watching tumble-bugs roll their balls in the dust. I named them "Bally" because I never recognized one of the beetles without his ball. I met hundreds of them, but it was not until years later that I followed one home. It required the maturity of adulthood to make me wonder, "Where do tumble-bugs come from? Where do they go?"

One overcast July day, in the pine country of the Colorado Rockies, I was able to show a friend the answer. On hands and knees we watched a pigmy-sized pair of tumble-bugs select a deer pellet from an abundant supply. Here was something new in the very beginning, tumble-bugs, too lazy to make their own ball, using a commercial product. We first noticed the pair on a double pellet. The smaller one secured a fast hold while the larger one prized the pellets apart. Then began a twenty-minute period of rolling, during which the beetles and pellet moved down a steep slope for more than thirty feet. The small beetle never helped at any time and never released his firm hold.

The fascination of Nature's sequences in adult life generally dates back to well-remembered incidents in childhood. A tumble-bug and his ball is a memory familiar to many of us. Greater knowledge and reward from Nature comes merely by expanding these incidents through the years, seeking an answer to the questions, "From where did it come? Where is it going?"

Twice the larger beetle lost the pellet but immediately returned and continued the remarkable feat of pushing upward with hind legs, head to ground. Obstacles that seemed insurmountable to us appeared in the path, but the work never ended. Two stops were made for exploration. Finally, a place between two stones, about an inch in diameter, was selected where the space between was less than a finger width across.

In the V-shaped notch where the stones came together, the little worker excavated a saucer-shaped depression about one-eighth of an inch in depth. Then the pellet was rolled into the hole and the bulldozing around the edge continued until the beetle disappeared below. As the pellet gradually sank into the earth the smaller beetle began to move about on top of the ball. He stood to one side of the lid of earth, looking down at the pellet. Just before the dirt caved in he walked down into the hole and rode the pellet out of sight. The dirt where they disappeared still heaved occasionally. At last the tiny mound was still.

As we walked away, I remarked, "There is a fellow whose prestige has fallen; who has lost his place in the sun."

The tumble-bug pushes its ball on dusty paths, or through grass jungles, seeking a place to bury the food it contains, either for itself or for its progeny. The journey seldom lasts more than half an hour.

The superstitions about tumble-bugs are legion, for Bally's history begins with the ancient Egyptians. His relatives, the sacred scarabs, were once emblems of eternity. Substituted for the heart in ancient embalmings, the emblem denoted reincarnation — the heart would beat again. Placed on the eyes, they would see again. It was also believed that only the male existed, a self-begotten and self-perpetuating being who typified the god *Kheperi*, the rising sun.

In the accounts of Fabre we learn that the Egyptians even fancied the ball as representing the earth, and that the movements of the scarab were influenced by the heavenly bodies. Maybe Bally is still useful in these modern days as a reminder of man's hope for immortality.

Maybe Bally's prestige has fallen. But he still has a fascinating way of life. If you want to see for yourself, set some stakes by his burrows and carefully dig one up every few days. Or better still, try growing your own tumble-bugs in a box with a peep hole for prying into their underground lives.

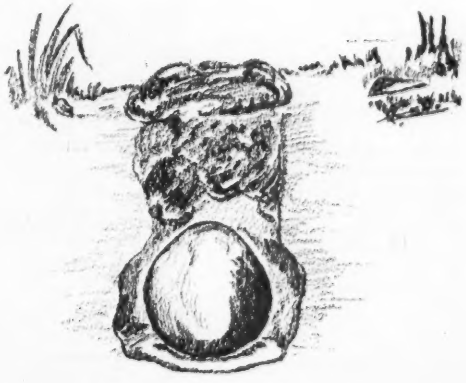
You will find that the making of balls is only the prelude to things that most of us never see. After the ball is packed into shape, rolled to a favorable spot, and buried, the insect may feast in his burrow until all of his food is gone. The feast may last for a week. He is admirably adapted for the fare he eats. A coiled food tube, ten times the length of his body, contains innumerable glands to produce the juices that digest the waste material from the ball.

Digging begins as soon as the burial site has been selected. The beetle excavates with its shovel-like head, working around and under the ball as the tunnel deepens. Below, the beetle goes first, and the ball follows. As the ball disappears beneath the surface, the loose earth caves in, concealing the hole.

In spring and summer the females bury balls in spherical cavities from two to five inches deep. Here soil is added to one side of the ball until it becomes slightly pear-shaped. At the "twig end" of the pear a creamy white, capsule-like egg, nearly five mm. in diameter is laid in a small cavity or cell. The mother then leaves through the tunnel she has dug. In the earthen cell the egg ultimately hatches.

The larva feeds on the surrounding dung and eventually plasters the interior of its spherical home with fecal cement that remains hard during the pupal stage. One day, when the rains have softened the walls of its cell, the new adult beetle emerges through the soil to begin its tumble-bug life.

The eggs and young, unlike those of many insects, are comparatively few in number. The female has



When the ball has been smoothed in its earthen cell, and soil added, making a pear-shaped object, the egg is laid at the small end. The beetle then departs to make and roll another ball. Only a tiny mound remains to mark the spot where, weeks later, a new tumble-bug will emerge.

one ovary, instead of two, and the relatively enormous eggs produced in the beetle's lifetime can be counted in dozens instead of hundreds or thousands.

In spite of the relatively few eggs, tumble-bugs can be found in considerable numbers. One summer day, after a gentle rain, I counted more than eighty beetles cutting up a cattle dropping. Some were feeding; others were cutting out pieces to make their balls. Still others were digging at the edge of the dung patch and transporting manure to their subterranean chambers. These last were not tumble-bugs but were relatives of Bally, with even more fascinating life histories than that of Bally himself.

How many insects are privileged to care for their young and exhibit something akin to mother love? Even the ants and bees are nursed by colonies or workers rather than by their queen mothers. But one of Bally's cousins, the *Copris*, cares for her own.

In the burrow for rearing her progeny the *Copris* deposits many pieces of dung. After a day or two of carrying, she kneads the mass into a flat cake two or three inches across. She spends another two or three days working her material into balls. Usually there are from four to six. And there in her dark cavity she remains. There through the days and weeks she smooths and polishes the balls while the eggs hatch and the larvae develop. She does not leave until her children are grown and emerge as adults.

It is possible for the *Copris* mother to see not only her children, but her children's children, and even her great-grandchildren. In Nature, these beetles rear several broods in a season and it has been estimated that an individual may live four years or more.

Not all of Bally's relatives are as long-lived as the *Copris*, and most of them are not as meticulous in their habits. For example, one species of dung beetle makes its burrow at the edge of cattle droppings and forms a single ball in the burrow. The ball is completely plastered with earth and the egg laid in the earthen covering. Another species forms its ball, which is a crude affair, beneath the dropping. Still another does not even make a ball. It merely lays an egg in a mass of manure in its tunnel. And, finally, one species takes the easiest way of all. It deposits its eggs in the dropping and the larvae develop there.

With all this rolling and digging and burying, who can say that Bally and his relatives do not have their place in the sphere of practical things? What better means of tilling the soil and introducing fertilizer can one find? The dung beetles are even believed to act as a natural control of the pestiferous horn fly by their disturbance of cattle droppings. But to me, Bally and his ball are sufficient compensation.

He has taught me to stay just a little longer, when I encounter him, to see the end of the first act. Of course, if I want to see the full show, I set a few stakes beside his mounds. Then in the weeks that follow I can return to dig up some of Nature's mysteries. No need to worry about destroying the breed by excavating a few balls. There are lots of tumble-bugs.

Recently, in the shortgrass country of eastern Colorado, I exasperated one of my scientific friends, whose main interest is cows and grass. I sat for an hour in the broiling sun, in the middle of a dirt road, while he repeatedly called me to lunch.

Finally, he stuck his head out of our cook shack doorway and yelled, "Are you sick?"

"Never felt better in my life," I yelled back.

"What in tarnation are you doing?" he persisted.

"Seeing Bally home," I replied.

★

Kingfisher

By SALLY MARSHALL WRIGHT

Majestically atop his swaying sentinel rush,
From singing dawn until the dying dark,
He perched, and eyed the pool below,
Lest one small fish should rise and make its mark —
A target for this wary watcher's eye.

But yet this dawn I find him in a foreign place,
And, too, I find him of a calmer breath;
This time a crumpled husk against the earth,
A shadow lying cheek to cheek with death.

It's time he found another mate, another rush,
For all his pond and rushes are too dim,
And death as his dark winged companion
Flies off into Eternity with him.

Harvester of the Past

By GIL STUCKER

Photographs courtesy American Museum of Natural History

Barnum Brown, bone-hunter extraordinary, with dinosaur rib. Considered the foremost field paleontologist, Dr. Brown has identified his life with the monsters of the prehistoric past. This rib was one of many bones discovered in a Wyoming hillside where 20 herbivorous dinosaurs died in a common grave. Jacketed in burlap and plaster-of-paris, the brittle bones are numbered, packed in straw and shipped to the Museum laboratory.

FEW MEN have done more exploring in the "lost world" of the prehistoric past than Dr. Barnum Brown, Curator-emeritus of Fossil Reptiles at the American Museum of Natural History in New York City.

The trophies of his many hunts adorn three halls in that world-famed institution, and range from dinosaurs to fossil figs. They represent a lifetime of collecting by muleback, plane, riverboat and foot in almost every corner of the globe. Nor is the end of them in sight, for today, at 78 and retired, this tall, scholarly scientist still carries on.

"Mr. Bones," they call him at the Museum. Since 1897 when he joined the staff, the man has bossed some thirty expeditions, gaining international renown as the No. 1 hunter of dinosaurs.

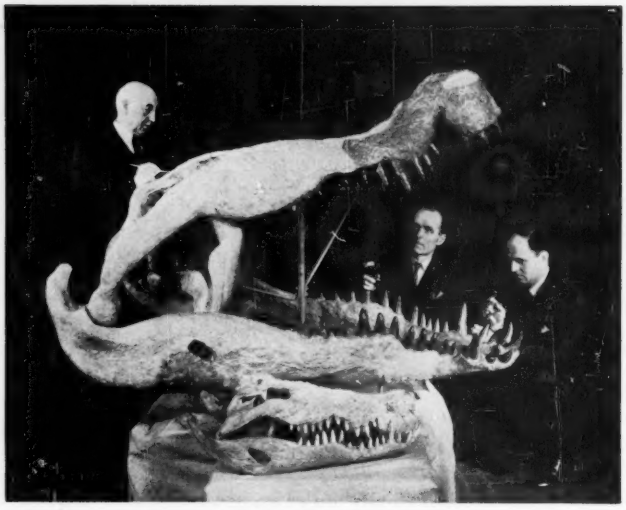
In pursuit of these ancient monsters he has led a life of color and hazard; was shipwrecked off Patagonia, drifting ashore on a hatch cover; tumbled into volcanos, fortunately extinct; faced death by drowning in a freak Wyoming flood; suffered sieges of malarial fever contracted on his tropic wanderings. Once, he danced with Lillian Russell (although this was not in the interests of science), and recalls, his blue eyes shining, memorable hours with such notables as the Duke of Windsor, Haile Selassie, the late King Gustav of Sweden and Kemal Pasha, whom he interviewed for an American oil company.

Roy Chapman Andrews, alluding to his solitary exploits in the field, calls him the lone wolf of explorers. "I have known him to disappear from the Museum like the Vanishing American," he says. "No one knew where he had gone — India, Burma, Greece, Canada or Wyoming. Invariably his whereabouts was disclosed by a veritable avalanche of fossils descending on us in carload lots."

On one of these junkets, to India, he married the sprightly Lilian McLaughlin, proving as adept a hand in matrimony as in paleontology. The Divorce Reform League later listed him among America's

The trachodons were among the commonest of dinosaurs in the days when our western deserts were junglelands bordering an inland sea that cut the continent from the Gulf of Mexico to the Arctic.

RESTORATION BY CHARLES R. KNIGHT



Built to the scale of the dinosaurs. The skull of Phobosuchus, a 40-foot crocodile that lived during the dinosaur era. Found by Dr. Brown (left) in the Big Bend of Texas, it dwarfs the skull of the modern crocodile in the foreground.

five best husbands, along with the late F.D.R. and Lou Gehrig.

Barnum's flair for fossils began, while he was still in knee pants, with an outcrop of Carboniferous rock. The rock was on his father's farm near Carbondale, Kansas, where he was born. In the rock were petrified sea shells.

Sea shells in Kansas! The boy was fascinated, and soon his collections of these and other interesting "finds" monopolized not only the front parlor but the barn.

It were as if a door to another world had been thrown ajar. Barnum placed his eye to the opening and some of the mystery of what he saw seeped into him; filled him with a desire to know. What must it have been like when Kansas was at the bottom of a sea? How did the plains come to be, and the rivers and distant mountains? A trip to Yellowstone Park in an old spring wagon with his father at the reins sharpened his curiosity. Completing high school, he determined to push the "door" wide open and cross the threshold, exploring down the long vistas of Time.

There were men to encourage him. Professor S. W. Williston of Kansas University was one of them. Barnum studied under him. Henry Fairfield Osborn was another. Osborn was organizing the department of paleontology in the American Museum when the young Kansan graduated. The department needed specimens. Could Brown get them? An assistant curatorship was his if he could.

Brown's answer was a systematic looting of the rock formations of the West, searching for the remains of those giant reptiles with which, as time passed, he was to identify his life. At Como Bluff, Wyoming, classic hunting-grounds for bone-diggers at the turn of the century, he excavated the Museum's first dinosaur.

Montana beckoned. In the Hell Creek badlands he made the prize discovery of his career — a 47-foot *Tyrannosaurus rex*, the warrior-king of the dinosaurs and largest land carnivore on record.

"Took us two summers to dig the critter out," Barnum explains. "First the overburden had to be dynamited off. Then, with heavy picks, team and scraper, we 'stripped' down to the skeleton . . . following up with smaller picks, chisels, whisk brooms and awls. As the brittle bones were uncovered they were shellacked and bound in burlap soaked in plaster-of-paris. This protected them in shipment. They needed it. It was 130 miles by horse-and-wagon to the nearest railroad."

That was in 1902. More than three decades later, not far distant at Harlowton, Montana, he was to find one of the smallest dinosaurs — an *Anchisaurus*, the size of a jack rabbit. In the years between, his busy pick ranged far and wide, tapping the very well-springs of the past.

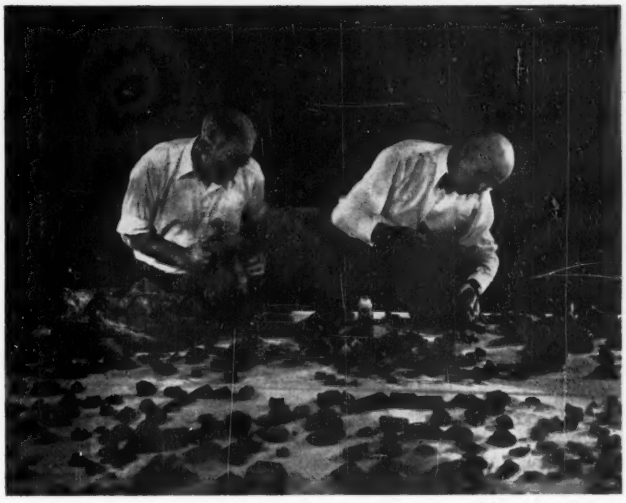
1911 saw the peregrinating digger in Alberta, Canada, prospecting the Cretaceous formations along the Red Deer River. He and some colleagues had built a flat-boat, pitched a tent on it, stowed enough supplies to last the summer, and shoved off down-stream.

One hundred and fifty miles later they had hauled aboard some of the strangest beasts ever conjured up out of the trick hat of creation — bizarre crested saurians like *Corythosaurus*, the dinosaur with the head of a cassowary; *Ankylosaurus*, an armored brute sporting a mace-like tail. Another had a large horn on its nose and went by the name of *Monoclonius*.

There were treasures of a different kind, too. Brown remembers cool dawns fishing breakfast out of the river — whitefish, pike, grayling, or the "goldeyes" herring that tasted so good when baked over live coals. He remembers nights "when you could hear the coyote cries echoing down-canyon, the drumming of partridges and the constant query of owls."

But all that, including the dinosaurs, was put aside when World War I broke. Barnum found himself in the U. S. Treasury Department as expert geologist appraising oil properties for tax assessment.

When next he took the field it was on safari in



Barnum Brown (right) and his assistant, Otto Falkenbach, assembling a dinosaur skeleton in the Museum laboratory. Specimens require months of tedious preparation before they are ready for study or exhibition. This dinosaur — *Hoplitosaurus* — was found in 20,000 pieces.

Abyssinia. The Museum had granted him leave of absence to investigate the petroleum possibilities of that country for the Anglo-American Oil Company. He did not find oil, but his haul of insects, reptiles and fossil invertebrates made the undertaking worthwhile.

"Brown never takes a loss," they remarked back in New York.

On the Museum's payroll once again, Barnum shifted operations to India. There, in the Siwalik Hills of the Punjab, he found the prehistoric fauna plentiful, unearthing much mastodon and hippopotamus material, a skull of the Pliocene giraffe, *Sivatherium*, and the largest known tortoise, *Colossochelys atlas*. This million-year-old titan measures seven feet down the back and weighed 2500 pounds when alive.

Extending his explorations to Burma, the scientist followed rainbow-colored Tertiary clays up the Irrawaddy River, collecting as he went. His bullock carts grew heavy with bones of extinct rhinos and odd, pig-like anthracotheres. In the jungle dusk near a small interior village he was astonished at sight of a *luminous* spider. The wary insect eluded capture and still remains a mystery to science.

Mandalay marked the end of Barnum's Burmese trek. It almost marked the end of Barnum. A near-fatal attack of malaria necessitated his leaving the tropics and finding a spot where he could regain strength.

Health returned on Samos Island in the Aegean Sea, where the rocks yielded the only complete fossil aardvark ever discovered, together with the remains of the okapi-like *Samotherium*, and some pre-Ice Age horse specimens. Three hundred species of living wild flowers also found their way into his kit.

Another rare item turned up as he was sniftering about the ruins of Hippocrates's ancient health center, the Asklepieion, on the nearby island of Cos. It was the milk tooth of a mammoth, presumably used by the Father of Medicine, himself, when he taught class there over twenty centuries before.

Five years of globetrotting; then home to New York. Research now — writing up his findings for the scientific journals. But Brown had explored too long to be happy at his desk. Soon he was out West again, taking up the dinosaur trail where he had left off.

The trail led, in 1934, to the biggest dinosaur "strike" since the Dinosaur National Monument was discovered at Jensen, Utah, twenty-five years earlier. In the upturned flanks of Wyoming's Big Horn Mountains lay the skeletons of twenty sauropods — monsters sixty feet and more in length, closely related to *Brontosaurus* and with long tapering necks and tails.

"Where the dead past buried its dead" team and scraper work to uncover 20 saurians of the Age of Reptiles. Big Horn Mountains, Wyoming.

Dragon bones in Wyoming. Buried for millions of years, the skeletons of 20 dinosaurs found by Barnum Brown in the Big Horn Mountains formed the second-largest dinosaur deposit in America, surpassed by only the Dinosaur National Monument in Utah.

The Sinclair Refining Company financed the excavating, giving it nationwide publicity that not only sold more oil but brought the dinosaurs, their life and times, closer to the American public than ever before.

That year was significant in still another sense. It witnessed the beginning of Barnum's aerial prospecting. Supplied with plane and pilot by his sponsors, he bolted a 24-inch Fairchild camera in the ship's doorway and took off on a 20,000-mile photo-reconnaissance of the Rocky Mountain States.

When the flight ended, six weeks later, miles of unexplored dinosaur beds had been located, plus an oil dome and an unidentified meteor crater. The photographs taken were some of the finest of their kind, many showing, in diagrammatic detail, the earth's geologic structure — the key to mineral wealth as well as to the secrets of the past.

Barnum was jubilant. "There's nothing like a plane for geologic scouting," he enthused. "One can do in two months what would take years on the ground. True, fossils can't be detected from the air, but rock strata can be traced out with a speed and precision hitherto unknown."

Two more dinosaur expeditions followed, the last into the Big Bend of Texas. And then, at the age of 69, he faced retirement.

Presently, he was back in Alberta, engaged in an aerial survey for the North Continental Oil Company. Basing his flights on Calgary, he "laced" the province in a Fairchild 71, his pilot a redhaired Irishman named Carrlon. When winter came he switched to a Beechcraft fitted with skis. Forty-five-thousand square miles they covered in quest of the liquid gold — flying north over Lake Athabaska and the frozen tundra into the land of the tar sands and the wood bison. On his map Barnum pencilled the areas that looked favorable for drilling.

Word of his activities spread. It reached the ears of the Duke of Windsor. His Highness had a ranch in Alberta. He wanted it tested for oil.

Brown was asked to do the job. But no sooner had a site been selected and the well "spudded-in" when the man was off on another petroleum hunt, this time to Guatemala. The Sohio Oil Company was retaining him to look into the oil potentialities of the Peten wilderness.

One hundred twenty three trips into the jungle he made, including 72 flights in a government DC-2, carrying jeep and aluminum boat for ground-checks. Oil traces were found.

A million dollars were made available for closer exploration. Difficulties arose over arrangements with the Guatemalan Government. Operations were suspended, pending settlement.

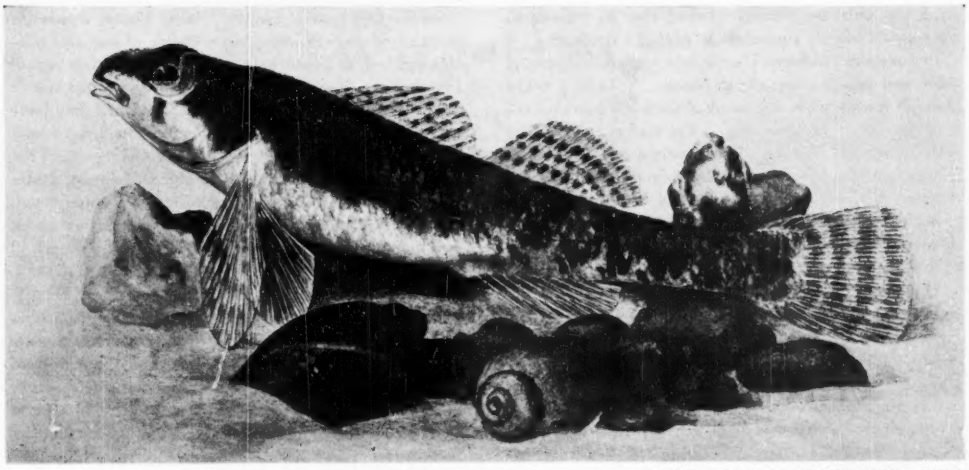
While waiting, Barnum went hunting for fossils. Near the village of Estanzuela he found one — a 10,000-year-old *Glyptodon*, somewhat smaller than a Crosley station wagon and looking like a giant armadillo. It will soon be mounted in Guatemala City's new Natural History Museum — another prehistoric wonder rescued from oblivion by Barnum Brown.

★

Island Reverie

By GILEAN DOUGLAS

Now the deliberation of the night
Is deep
Upon the water. Darkness fills
The placid bowl between the island hills
And sleep
Comes limpidly as thought upon delight.



COURTESY ILLINOIS NATURAL HISTORY SURVEY

Johnny Darter, known to science as *Boleosoma nigrum*, is an important dweller in brooks with gravelly bottoms and an interesting inhabitant of the home aquarium.

Johnny W. Darter, Bellboy of the Brook

By EDWARD V. BERARD

WHEN a friend of mine, an avid tropical fish fancier, invited me to view some of his newly-acquired pets, I expected to be shown the usual galaxy of hues. We stopped, however, directly before a nondescript-looking tank. All I could see was a charming underwater scene and a block floating on the surface. Then I saw a diminutive, sandy-colored fish with six or seven monogrammed "W"s along his flanks, resting upside down on the under surface of the block. He could not have been more than two inches long from the tip of his somewhat decurved snout to the end of his brown-etched tail.

"Meet Johnny W. Darter," said my friend, "He's my bellboy." Almost as if he had been paged, the fish turned his head as if to hear more clearly, rolled his large eyes, and then streaked off to the bottom of the tank and vanished in a whirl of sand. His whereabouts, however, were revealed by the lustrous dark eyes near the top of his head, although the rest of his body remained buried.

"Well, he's different," I remarked foolishly. The Johnny Darter, a member of the perch family was a new fish in my life. My friend regaled me with tales of the speed, agility, intelligence, and all-round entertainment value of this newest pet. When he finished, I asked from which pet shop he acquired this paragon.

"That's the most amazing part," he said. "I captured him in the brook down at the end of the street while minnow seining, and he was such an unusual looking animal that I brought him home. He's been the prize of my collection ever since."

Since this incident I have had further opportunities to study these veritable sprites of the brook. Found almost everywhere east of the Mississippi River, the Johnny Darters are usually abundant in most streams, and especially small brooks with gravelly bottoms where the irregular brownish designs on the back and sides blend to make the darter almost invisible from the surface. Its presence is betrayed by periodic "darts" over the bottom, as if in answer to calls heard only by itself. Thus the darter is one fish that truly lives up to its name. Even closely confined, it is agile.

Only the two spiny-rayed top fins indicate the close relationship of the Johnny Darter to the much-prized yellow pikeperch, or wall-eyed pike, and the yellow perch. However, like these larger voracious feeders, the Johnny Darter scorns the herbivorous diet, his main item of sustenance consisting of insect larvae. David Starr Jordon and H. E. Copeland, both pioneer American icthyologists, once observed a darter in an aquarium grabbing a snail by the head, and dashing the unfortunate victim against rocks and the side of the tank until the shell was broken. At other times they watched the darter wait, cat-like, in front of a snail

until the creature timidly pushed out its antennae, whereupon Johnny immediately snapped them off.

In courtship, Johnny Darter is a romantic suitor, if color and activity are any criterion. Spawning takes place in spring, when the head of the male becomes extremely dark. In spawning, nests are created by the male under flat objects. The female moves about the ceiling, upside down, with the male astride but not clasping her while she lays several hundred eggs in circular patches, one layer thick, that may reach a diameter of five inches. The egg itself has a diameter of less than one-sixteenth of an inch.

From one to three males may be found under the same stone. However, the male Johnny Darter guards his female from all other suitors, although he himself occasionally acquires more than one mate for the same nest.

The Johnny Darter then shows himself to be a better family man than certain close relatives, for he guards the eggs until they hatch. During the five-to-seven-day period of incubation the adult male rests with the head away from the eggs, while the constantly vibrating tail is directed towards them. This arrangement keeps water constantly circulating through the eggs.

When the eggs hatch the young are less than one-quarter of an inch in length. Each one possesses a small yolk sac upon which it subsists until it reaches a size large enough to enable it to capture larger prey, such as water mites and the smaller insect larvae.

In the first year of life the Johnny Darter makes his most rapid growth, reaching a length of one and one-third inches, or about two-thirds of his ultimate size of two inches. Some of the faster-growing darters spawn at the end of this period, but most wait until they have attained the age of two years before reaching sexual maturity. An interesting sidelight to the growth of the Johnny Darter is the fact that the males grow faster than the females after one year of growth is completed. While the average full-grown darter measures about two inches, there are records of giants with a length of approximately three and one-half inches.

Life is not without its pitfalls for the Johnny Darter, for it constantly has to elude larger fish that consider him a choice morsel. Two of his chief predators are the highly prized small-mouth bass and the wall-eyed pike. So Johnny Darter, in addition to being a source of interest and entertainment to fanciers, is also of some economic importance as forage for our better fresh-water game fish. Occasionally the bluntnose minnow snatches an egg from the nest, and frequently a crayfish seizes a darter as he rests.

Even as he makes short darts across the stream-bed in search of food, or a mate, so our Johnny Darter darts rapidly through life. Few of his race live beyond three years, although some attain the age of four. Death, presumably through predators, soon overtakes the small speedster. Perhaps if Johnny W. Darter had a motto it would be "Live quickly? Die quickly!"

Wood Ibis

By JEANNE SMITH TENNEY

ALTHOUGH various herons and egrets are seen daily near the little "banana town" of Golfito, Costa Rica, the wood ibis is rare. Quite near the town, but in the woods on the bank of a small stream, I had set up a "blind" of poles, covered over with leaves of palms and "bijagua," a wild relative of the banana.

Early one morning I had adjusted a camera inside the blind, focused on an area of sand bank in the stream, hoping to get a heron picture. I had been settled for a few minutes, when a wood ibis, *Mycteria americana*, flew down and alighted exactly in front of my camera. Folding his great wings he stood quite still as though posing for his picture. Not to lose my opportunity I pulled the string on the lever, fully expecting to get only the one picture, for I thought the snap of the shutter would frighten him away. But he seemed entirely oblivious of either the queer structure of leaves on the bank, or the sound of the camera's click. He leisurely began to feed among the grasses.

Presently he walked, in comical dignity, past the camera again, and I snapped a second picture. The plumage of this ibis is entirely white, except for the jet black wing and tail area. The head and upper neck are bare of feathers, and the skin is a pinkish, dusty-gray color. These birds fly with neck stretched out.

What House Plants Tell

By E. LAURENCE PALMER
Illustrated by Nancy Harrington

This is the sixty-third in NATURE MAGAZINE'S *series of educational inserts.*

GERANIUM

ROSE GERANIUM

PETUNIA

LEST you think by the above title that I intend to personify house plants, and have them tell you the stories of their lives, let me reassure you. We know that actions speak louder than words. Then why cannot the evidence of actions tell us something? Step from a home or room of an individual who loves plants enough to care for them, into a room that is efficiently bare or brightened only by cut flowers cultured by someone else, or where there are no flowers at all, and I rather think that your whole attitude will change. Poets have tried to express this thought in various ways.

In 1928, for example, a student of mine, Eleanore Johnson, wrote of her great-aunt Penelope:

"To her, all homely things were beautiful—
The patterned sunlight on the kitchen floor,
So sweet and white and shining; or a door
Left half ajar into a shadowed room,
With pot-pourri's faint fragrance in its gloom,
I think perhaps these brought the deepest thrill,
Just red geraniums on her window sill."

I can remember little of my grandmother Palmer except that she was large and fat and waddled. For all of these handicaps, I always forgave her because of the geraniums in her farmhouse kitchen window and the smile on her face as she attended to them. I hope that you have, or have had, an aunt or grandmother who loves, or loved, house plants. If so, you are truly rich.

From these glimpses of obviously wholesome happy lives, let us see how another Cornellian, a classmate of mine, Dana Burnet, pictured the hopeless misery of a city child striving to reach great-aunt Penelope's serene happiness. In his remarkable poem, "From an 'L' Train Window," we read this contrast.

"I had left sunshine on my study floor,
Laughter behind me in a woman's eyes,
Paintings and books and friendly smiling things,

GERMAN IVY

COLEUS

BEGONIA

ASPIDISTRA

ASPARAGUS FERN

ZEBRINA

POINSETTIA

The sum of which is mortal paradise.

And then a child, with eyes to break my heart,
Leaned from a window and with hands that shook
Poured water on a dead geranium—
And that alone was worth a wise man's book."

A. A. Milne, in his inimitable *When We Were Very Young*, touches on the story in the verse "The Wrong House," and in "The Dormouse and the Doctor," where the ill dormouse did not want the chrysanthemum prescribed by the doctor but just that

"he knew there was nothing we wanted instead
Of delphiniums (blue) and geraniums (red)."

Don Blanding, writing of his Hawaiian Garden in "Vagabond House," which every naturalist and flower lover should read, says

"I plant my flowers, row on row
In hope that they will grow just so,
All neat and sweet, but I forget
That while the phlox and mignonette
Are used to garden ways and know
The proper way that they should grow,
These tropic blossoms will not do,
The sort of thing I want them to."

Can anyone read these quotations from persons who do not make their livings as professional raisers of flowers and not be convinced that, down inside each of them, there is something basically fine and worthy of emulation? It may be found in the professional man with his cut flower in his buttonhole, or in the heartthrob with the gardenia

MONSTERA

RUBBER PLANT

SPIDERWORT

on her coat, but I think it is something different. I doubt if it is always to be found in the mercenary peddler of flowers, or in the commercial raiser of flowers to be sold to the market, although it may be. I am sure it is not in the flower-banked coffin of a gangster.

I would deny this sentiment to no one. What I want to associate with house plants is the relationship between a house plant and a human being, an association in which the human being, without financial reward, willingly gives each day, or at least every few days, some care to a thing that makes a little spot in the world more beautiful than it otherwise would be. I have seen it in a janitor in an engineering laboratory, in a teacher in a one-room school, where the floor had holes in it through which the children could easily step. I have seen it in the homes of the wealthy, where the servants were not allowed to care for the flowers loved by the "master," and in shacks made out of junk and with the flowers growing from beer cans. I have failed to see it in some schoolrooms, where it should be at its best.

I will never forget the incredulous look on the face of a biology teacher in New Zealand who could not understand what I meant when I asked her if she had any living things in her classroom. She was as dead and as uninspiring as her program and as her room, but she was the exception in that country where the love of flowers cannot be matched in any part of the world I have ever visited.

In his "Book-of-the-month-club" best seller, *Return to Paradise*, James A.

BOSTON FERN

NORFALK ISLAND PINE

CHRISTMAS CACTUS

AFRICAN VIOLET

SANSEVIERIA

Michener gives us twenty-three pages on New Zealand in which I find only two lines acknowledging the New Zealander's love of flowers. He says: "New Zealand life is wonderfully pleasant. Each home has a garden of glorious flowers." This obvious understatement is rather unfair, although I am in general agreement with Michener's evaluation of that wonderland, even though he was a bit rough on the kea.

While we write of house plants and the love of humans for them, there are, however, a few rules that may help anyone grow bigger and better flowers. My grandmother and, I presume, great-aunt Penelope, did not live in a home heated with gas. Milne's dormouse slept outdoors in a bed of house plants, and Blanding took them outdoors and "let 'em run." Burnet pictured an attempt to save the dead geranium by putting it out on a tenement fire-escape. Michener wrote of a land where the houses are as cold indoors as the weather is out.

Most of us Americans, with our "central heating" and thermostats, place the life of most house plants in jeopardy the minute we bring them indoors. The air in your home may well be poisoned with gases that may not affect you, but certainly will affect some plants. At night, your house may not cool off as did the wood-stove-heated house of my grandmother, and, believe it or not, this cooling-off process is just what some house plants need. Some of us are not in position to sort of turn our house plants "out to pasture" in a garden in the summer, and let them there develop a vigor and reserve that may make it possible for them to live indoors with us during the winter. Usually, we overcome these difficulties by throwing the plants that fail into the garbage can and buying a few more victims to sacrifice on the altar of civilization.

With a little care, this waste may not be necessary. If our houses are constantly warm, and the air inhospitable, then the best thing for us to do is move to more suitable quarters where we can run the show, or resign ourselves to growing those plants that can "take" whatever Fate seems ready to "dish out" to them. The chart section of this insert suggests the sensitivity and hardiness of some of our common house plants in these respects. If coleus gets badly infested with mealy bugs and we cannot safely fumigate the room in which they grow, then just forget coleus and learn to be satisfied with sansevieria or aspidistra as foliage plants. If things have to be moved at frequent intervals, let us not expect a Boston fern, or a Christmas cactus, to match those found in the homes where this is not done. If we have limited space in which to grow our plants, then let us avoid trying to grow monstera, or even German ivy, petunias or wandering jew.

Experience may tell us more than any book or magazine article about these matters. If one apartment in a huge building can grow house plants successfully, there would seem to be no reason why another apartment similarly situated might not be suitable. It might be worthwhile to explore the neighborhood and see what plants are making a go of it. Talk over your problem with the owner of such plants and maybe you will make a friend, and even get a few slips to start your (Continued on page 480)

NAME SCIENTIFIC NAME	BOSTON FERN, A SWORD FERN *Nephrolepis exaltata bostoniensis*	NORFALK ISLAND PINE *Araucaria excelsa*	CERIMAN. MONSTERA *Monstera deliciosa*	WANDERING JEW *Zebrina pendula*
DESCRIPTION AND RELATIONSHIP	Order Filicales. Family Polypodiaceae. A crowded mass of fronds, each to 5 feet long and unbranched, but composed of pinnae, each to 4 inches long and nearly an inch wide, and varying from being entire to wavy marginned. Usually a rich, dark green above and lighter beneath.	Order Coniferales. Family Pinaceae. Tree reaching, in native setting, height of over 200 feet and trunk diameter of 10 feet, conspicuous because of storied planes of whorled branches arising horizontally from unbranched trunk. Young leaves to ½-inch long, curved, sharp-pointed; older leaves closely crowded.	Order Arales. Family Araceae. Climbing woody evergreen with numerous clinging or free-hanging roots. Stems branched, coarse, sprawling, erect or twining. Leaves to 3 feet long and nearly as broad, petiole and blade about equal, thick, pinnately cut with many elliptic holes in mature plants.	Order Xyridales. Family Commelinaceae. Weak-stemmed, drooping or prostrate herb, branched, sparingly hairy. Leaves, alternate, entire, without petioles, coarsely striped above in dark and light green and blue beneath, smooth or slightly fuzzy, pointed or bluntish, somewhat succulent.
RANGE	Wild form native of tropics in both Hemispheres, but this variety developed or introduced into spectacular popularity about 1895, since when it has more or less eliminated the typical species from leadership in popularity. A dozen or more horticultural sub-varieties are well established.	Native of Norfalk Island in tropical Pacific, but established widely in other tropical areas with similar climate doing well in northern New Zealand, and even in some parts of tropical and sub-tropical America, where it is grown outdoors as a successful ornamental. Related *A. columnaris* has close resemblance.	Native of tropical America particularly Mexico and Central America with genus represented by some 30 species. Favors warm, moist, protected climate, but some can resist near-freezing temperatures. Related *Monstera dubia*, known in trade as *Marcgravia paradoxa*, lacks holes in young leaves; fewer in adults.	Native of Mexico, New Mexico and Texas, but widely established in the world as a house plant, as a garden plant, or as an escape that may "take over" a considerable area. Related *Tradescantia fluminensis* is often considered as Wandering Jew and is native of Brazil, Uruguay and Paraguay.
REPRODUCTION	Spores are produced from brown spots on under sides of slightly modified terminal pinnae of the drooping fronds, with the sexual stage developing from the germination of these spores. Spores are wind-borne and develop on moist surfaces. Few if any spores produced normally.	Staminate catkins are to 2 inches long, but pistillate cones are to 5 inches in diameter and resemble a slightly pointed orange, or, better yet, a shortened pineapple without the usually terminal leaf cluster. Cone scales end in stiff, incurved spines that provide effective protection from some enemies at least.	Flowers with foot-long, white outer part, as in calla lily, surrounding a 10-inch, club-like spadix of crowded, 6-sided flowers. Fruit matures into 8-inch pine-cone-like green structure, which tinges with yellow when ripe and tastes like a banana-pineapple combination, and is, of course, edible.	Flowers borne between two leaves. Sepals and petals unite to form a tube that is white and bears ½-inch purple segments, 6-parted, the color varying with the different varieties. Six equal stamens borne on corolla throat. Fruit 3-celled and bearing usually 2 seeds per cell.
ECOLOGY	Reproduction primarily by runners, since few spores are normally produced by the apparently prolific sori. Normally runners are cut from base of parent plant, rooted in 6-inch pots. Plants may be injured by hellebore or pyrethrum sprays commonly used on house plants.	Grown either from seeds or from cuttings, those grown from seed usually less desirable for house use than the dwarf forms grown from cuttings. Some still prefer vigorous seed-grown plants. Do best where night temperatures do not exceed 60°F., and where long exposure to direct summer sun may be avoided.	Propagated by putting 3-joint cuttings in 3-inch pot of sand, peat and leaf-mold, holding at 75°-80°F., and 65°-70°F. at night under glass to hold humidity, syringing plant frequently until it is well established. Needs much water in growing spring and summer months. Relatively few insect pests normally.	Normally under home management reproduction is by cutting or layering, since the stems root freely in contact with the soil, or start roots from stems left in water. Biology teachers commonly use epidermis of leaves under microscope to demonstrate stomata and stamen hairs to show protoplasm movement.
USE	Justly popular house plants that do best if left undisturbed, particular care being necessary not to injure growing tip of fronds if long fronds are desired. Normally runners cut from parent plants might develop into salable units with a three-week period.	In native areas plants yield valuable lumber, particularly useful to ship builders because of workability, durability and strength. Principal value in America lies in ornamental value of plants grown indoors in the North, or outdoors where climate is suitable in the South.	Grown frequently as an indoor ornamental and curiosity, a 15-foot plant being considered relatively young. Fruit is eaten regularly in tropics, but does not yield to efficient shipment and cannot be considered commercially important. Abundant liquid feeding in summer stimulates vigorous growth.	As house plants may be "thickened" by breaking off tips of branches, inducing further branching. Best temperature is between 60° and 70°F. plants may be grown for considerable time merely stuck into a vase of water. In suitable climate the plant may sometimes be considered a weed.

SPIDERWORT *Tradescantia virginiana*	ASPARAGUS FERN *Asparagus plumosus*	ASPIDISTRA *Aspidistra elatior*	BOW-STRING HEMP *Sansevieria* sp.	INDIA-RUBBER PLANT *Ficus elastica*
Order Xyridales. Family Commelinaceae. Stems erect, smooth or slightly hairy, to 3 feet high. Leaves narrow and somewhat grasslike, to 15 inches long, drooping or slightly twisted, alternate in the lower areas, keeled. Bracts below the flowers are leaflike to 8 inches long. Stems are unbranched.	Order Liliales. Family Liliaceae. Stem usually to 4 feet or more, slender, tough, climbing or twisted, smooth, woody, freely branched, forming attractive frond-like sprays, with a few short spines. "Leaves" flat, green, leaflike branchlets to an inch long and ¼-inch wide. Roots long and slightly fleshy.	Order Liliales. Family Liliaceae. Height to 20 inches. Leaves arise directly from tough rootstocks that are supported by many finer roots. No tall flower stalk. Leaves are entire, usually, drooping in upper half, often folded lengthwise above, to 2 feet long and 4 inches wide, smooth green, or variegated.	Order Liliales. Family Liliaceae. Leaves spring directly from the root and may be to 8 feet long and 3 inches wide, thick, tough, erect, entire, flattened, pointed at the tip, colored variously, but commonly with lighter borders and with mottled center portion, rounded on the back, relatively smooth.	Order Urticales. Family Urticaceae. In the native tropics the plant becomes a tree, reaching a height of 100 feet, but as a potted plant a height of 10 feet is rarely reached. Stems coarse, elastic, milky juiced. Leaves entire, to 1 foot long, dark shining above and lighter beneath.
Some 50 species in the genus. One *T. flammineus* is prostrate and bears the common name Wandering Jew, which is also used for Zebrina. *T. virginiana* is raised in gardens and indoors, but is native and hardy from Maine to Virginia, and west to the Rocky Mountains. It appears as an escape outside its range.	Native of South Africa. Horticulturists recognize a dwarf form *nanus*, and a similar *compactus*, and a husky *robustus*, with a super-robust *comorensis*. The plant is of course closely related to commercial asparagus, *A. officinalis*, which is so justly popular as a food plant.	Native of China, Japan and Java, and up into the Himalayas, with nearly a half-dozen species. This species is best known as a foliage plant grown in pots the world over, with some horticultural varieties involving usually leaf coloration and habit, some leaves being conspicuously striped in white and green.	Of the 50 species most are native of Africa and Asia. Many are suitable for cultivation and they are one of the hardiest, most popular house plants because of ability to survive without direct sun, with neglect and because they handily fill a corner in an ornamental way. Named after a Prince of Sanseviero.	Native of northern India and the Malayan regions, where it grows wild in damp, forested areas. Most commonly observed as potted plants in hotel lobbies, although they are going out of style in this respect. Requires hot, humid atmosphere and an abundance of water not needed by many other plants used similarly.
Flowers borne in clusters at the tip of the branches. Appear in many varieties, rose, red, purple, blue or white, single or double. Sepals may be hairy but are not glandular. Petals are to 1 inch long. Stamens are hairy on the filament portion. Flowers do not last long once they are picked, and are at best on plant.	Flowers are borne in clusters of 3 to 4, on short stems to ⅛-inch long, at the ends of twigs. Calyx-like corolla is whitish or pinkish, composed of 3 segments that are united into a bell-like form. Flowers appear in fall. Fruit a spherical, blue-black berry containing 1-3 seeds that germinate in 3 weeks when planted.	Flowers appear in spring, are borne singly at the surface of the ground, are to 1 inch across, purplish-brown, although frequently pass unnoticed. The 3 petals and 3 sepals are all colored alike and joined into a common tube. Ovary is 4-celled, but fruit is a 1-seeded berry.	Flowers borne on erect stems that develop rapidly and branch to form open clusters. Flowers are intensely fragrant, white or yellow, with swollen tubular bases, which bear 6 stamens at the throat. Fruits are 1-3 seeded berries, 3-celled and there are 6 stamens.	Fruits are borne in pairs, are to ½-inch long, and are found in the axils of old leaves, are at first covered with a hood shield, but this is lost and the ripened fruit is yellowish-green. Maturity of the tree is not reached until about 50 years but a 10-foot potted plant is not an attractive house plant.
Hardy hothouse plants easily propagated either from seed or from cuttings. While the flowers are attractive when the plant is grown in a green house or home it is usually used as a foliage plant, which may be traded with neighbors by simple slips rooted in a glass of water and then planted.	Common reproduction is by dividing underground parts each section having one or more "eyes." New plants are set in sand enriched with liquid manure in the dark. At 60°-70°F. they develop rapidly. Seeds are soaked a day in water before being planted, and within a year may develop good-sized plants.	Common horticultural practice calls for reproduction by dividing underground parts. Best temperatures are between 60°-75°F., although the plant survives surprising extremes and can stand fumes from gas stoves that would normally kill most house plants. Survives dust, drought and neglect and has few insect pests.	Propagated by cuttings of the leaves 3-inch sections rooting in a month in heavy soil or in sand or may be propagated by simple root cuttings. Known as "snake plant," "mother-in-law tongue," "murta," "murva" and by other names. Next to geranium may be commonest of our house plants.	In native haunts trees when mature have huge buttresses and conspicuous prop roots. Some plants may start life as epiphytes supported by other plants but when a root system is established in contact with the earth the plant becomes independent. The greatest value is probably as a house plant when young.
Botanists recognize a host of varieties of the species, and many species as well. They also use the hairs on the filaments of the stamens to demonstrate protoplasm circulation. Tradescantias are popular the world over as house plants because of their hardiness and simplicity of propagation.	A most popular greenhouse and house plant, the sprays being used to "lighten" bouquets of large flowers. Cutting may stimulate even greater growth in established plants. Plants are started in summer. Growth is stimulated by ammonium sulfate at 1 ounce to 2 gallons of water applied weekly. Badly infested with "white fly."	Plant is one of the commoner hotel plants, and is so hardy it has been called the cast-iron plant since nothing seems able to kill it when compared with conditions that are fatal to other plants. Potted plants can be moved frequently with safety, a condition which might ruin Boston fern, for example.	In India, South China, Java and elsewhere is grown commercially for fiber, an acre yielding 13 tons of fresh leaves that yield 50 pounds of fiber to a ton. Fiber is soft, pliant, strong, uniform throughout length, silky but more difficult to process than sisal. It is extracted by machinery.	In native jungle milky sap is allowed to accumulate on trunk or drip onto mats. It is then scraped off, cleaned and dried usually by most inefficient and wasteful methods. After due processing India rubber or Assam rubber is produced but this cannot compete with native rubber from caoutchouc, Para rubber.

NAME SCIENTIFIC NAME	CHRISTMAS CACTUS *Zygocactus truncatus*	POINSETTIA *Euphorbia pulcherrima*	BEGONIA, WAX PLANT *Begonia semperflorens*	HOUSE GERANIUM, FISH GERANIUM *Pelargonium hortorum*
DESCRIPTION AND RELATIONSHIP	Order Opuntiales. Family Cactaceae. In wild, plants hang in profusely branched clusters from branches of trees. Potted plants show erect, branched stems composed of flattened sections, with upper portion of each section incurved like a cup, from which 2 or 3 other sections may arise. Sections are to 2 inches long and 1 inch wide.	Order Geraniales. Family Euphorbiaceae. Herb or shrubby plant that reaches a height of more than 10 feet with stems erect and weaker at the top. Leaves to 6 inches long with entire or few-toothed margins and conspicuous veins, usually fuzzy beneath. Milky juiced. Upper leaves narrowest.	Order Violales. Family Begoniaceae. Herb with weak, succulent but rather erect, greenish or reddish stems to 18 inches high. These are usually smooth, zigzag, but not so branched as would appear. Leaves to 4 inches long, oblique based, with toothed margins with hairs between the teeth on the margins. Roots fine and fibrous.	Order Geraniales. Family Geraniaceae. Stem becomes woody when grown in open, but in house plants is succulent. May reach height of 15 feet, branches freely and like the rest of the plant yields a pleasing pungent odor when bruised. Leaves with blades to 5 inches across, kidney shaped on long petioles. Roots fibrous.
RANGE	Native of Brazil, but so many horticultural forms have been developed that the original form is not commonly found. Hybrids with *Cereus* and *Epiphyllum* are relatively common, and to some horticulturists the plant belongs in the genus *Epiphyllum*. Because of its sprawling habit in part it has been given the common name of Crab Cactus.	Native of Mexico and Central America, but the plant is best known at the Christmas season when it is a popular potted plant in most places where this holiday is celebrated. The blazing vermilion upper leaves that appear below the flowers are, of course, the main point of interest.	Native of Brazil, but has been so popular with florists for so long that a wide variety of forms have been developed, many of which have established trade names and some of which are hybrids between this and other species. Known as everblooming begonia in contrast with rex begonia and tuberous-rooted begonias.	Plant is probably a horticultural product involving many other plants, most of which probably originated in South Africa. In climates as mild as southern California it is perennial. Common varieties include the light pink Enchantress, the red Red Barney, the white Mme. Buckner, the brick-red Red Fiat.
REPRODUCTION	Flowers grow from ends of the younger joints horizontally, are to 3½ inches long, with segments of both calyx and corolla curled backward, showy and usually some shade of red. Stamens are numerous, with long pink filaments. Fruit pear-shaped to nearly ½-inch in diameter, red when ripe. Flowers drop from plant easily.	Flowers are relatively inconspicuous and appear in clusters at ends of branches just above the brilliant upper leaves. Individual flowers are about ¼-inch across and bear a large yellow gland to one side, the flower structure being unusual and confusing except to specialists. Fruits are smooth capsules.	Flowers in small clusters with the staminate in 4 parts and to an inch across, while the pistillate are smaller and of 5 parts. Pistillate flowers have the broader petals. Petals are rose, pink or rarely white. Stamens are many and yellow. Pistil bears conspicuous wings, a twisted stigma and 2-3 cells.	Flowers normally appear on house plants in late winter, but, grown in beds outdoors, they bloom profusely in late summer. Flowers borne in clusters on end of long stalks coming from base of upper leaves. Petals, 5 and sepals 6 in single forms. Fruit long and slender in 5 parts that split free at the base.
ECOLOGY	Commonly propagated by stem cuttings in good garden soil, 2 parts to 1 part sand, with good drainage. Water should be given sparingly except when blooming. Sun is essential and ideal temperature is between 60° and 70°F. Plant is commonly grown in greenhouses in baskets and on rafters. Flowering is erratic and not dependable.	Plants may be made to survive if, after flowering, they are allowed to dry in temperatures from 50°-60°F. for a period of 3 months. In spring they are repotted in rich soil and cut back vigorously. Cuttings are made in morning and rooted in sand for 16 days, then can be transplanted. Wet raffia tied to stems induces roots.	Cuttings are made in spring and summer from old plants, may be repotted in late summer and grown indoors for a year. Best temperatures are 60° to 70°F. in the soil with good drainage and water supply. Light is necessary but need not be direct sun and in fact should not be. Plants are frequently badly infested with mealy bugs.	Soil must be high in phosphate and potash. In wholesale culture cuttings are set in June a foot apart. Best soil temperature 50°-70°F. Buds show about 4 weeks before blooms are at best. Leaves should not be watered. In beds fertilizer is applied 20% super phosphate at 10 pounds and 1 pound potassium chloride to 100 square feet.
USE	After house plant has passed blooming, water should be withheld for some time. Once a plant seems to be doing well it should be left undisturbed, repotting usually being undesirable under such circumstances. When it is in good shape the plant is usually considered a prize possession.	Commercial plants are nurtured with precision to be at best at Christmas season. Plants are fed urea at rate of 1 ounce to 5 gallons of water, or ammonium sulfate at 1 ounce to 2 gallons of water every 2 weeks. Best growing temperature is 60°-65°F.	Cuttings of begonias are common exchanges of neighborly feelings and slips of leaves or stems may be successfully rooted in water or in damp soil. Best soil includes sand and leaf mold. Some plants like *Gigantea rosea* are sterile hybrids.	Possibly the most popular of all house plants. Tops may be cut back and root systems used 2 or 3 winters. May be propagated either from cut stems or leaves. Overwatering and poor ventilation cause serious leaf spot disease and fresh manure should not be used as fertilizer for geraniums.

ROSE GERANIUM *Pelargonium graveolens*	AFRICAN VIOLET *Saintpaulia ionantha*	PETUNIA *Petunia hybrida*	COLEUS *Coleus blumei*	GERMAN IVY *Senecio mikanioides*
Order Geraniales. Family Geraniaceae. Most commonly seen as a greenhouse plant that rarely exceeds a height of 3 feet but shows old woody stems, free-branching habit. Leaves deeply cut into 5 parts, each part being further divided, with long stiff petioles. Perennial in suitable climate.	Order Polemoniales. Family Gesneriaceae. Commonly stemless, the leaves and flowers arising from a tuft, although sometimes there is a short stem in older plants. Leaves hairy, in the type species to 1½ inches long, but in some horticultural varieties to 8 inches, most of which is petiole, with rounded, shallow, marginal teeth, often variegated.	Order Polemoniales. Family Solanaceae. Height to 4 or even 5 feet where proper support is provided and climbing is encouraged. Stems semi-woody, perennial, much-branched, covered with sticky short hairs. Leaves with somewhat heartshaped blades, the upper without petioles, sticky alternate below and opposite above.	Order Polemoniales. Family Labiatae. Coarse herb or almost a shrub in mild climates. Height to 3 feet, with square, sparsely branched, weak, smooth stems. Leaves variously shaped and colored but rather conspicuously veined, pointed, green, red, yellow, maroon or brown, with slightly wavy margins.	Order Campanulales. Family Compositae. Stem weak, drooping, sprawling or weakly climbing and twining, uniform in diameter for great lengths, smooth, green and many feet long under ideal conditions. Leaves alternate, smooth, 5-7 angled or lobed, most abundant and largest at base of plant, pale green. Annual.
Native of South Africa. To some, this is more desirable for window box and indoor purposes than the House Geranium. Its fragrance is decidedly different and the more finely cut leaves offer an added appeal. This species is popular in Spain and France, the related *P. odoratissimum* in Texas and Florida.	Native of tropical Africa but widely grown as a house plant in many parts of the world. Two common species are cultivated for ornament, *S. ionantha* with wavy margined leaves and *S. kewensis* with entire leaves that are more shaggy and hairy. Two others are not so commonly grown.	Evolved from crossing of many species, probably mostly of *P. axillaris* and *P. violacea*. There are some 25 species mostly native of South America and its southern parts in particular. May become established as an escape in regions where ample protection is provided in severe weather.	Developed from many stocks, although parent stock probably came from Java. Some 90 species and many more varieties, with some closely related forms from Africa. Related *C. thyrsoideus* is shrubby, with fuzzy stems and to 3 feet high and with coarser leaves.	Native of South Africa. There are more than 1200 species in the genus, making it one of the largest genera. This with *S. scandens* makes the 2 species that are climbers. Plant is probably best known as a house plant or as a greenhouse plant. It is primarily an attractive foliage plant.
Flowers borne at end of long stems arising from bases of upper leaves, in clusters of many flowers. Petals are commonly rose or pink, as name implies, and the upper 2 and larger of the 5 are usually purple veined. Fruit is slender, 5-valved and ruptures from base, freeing the seeds with slings.	Flowers in clusters numbering to about 6, on stems to 4 inches long. Calyx relatively small, of 5 slender lobes supporting the shallow tube of the 2-lipped but 5-lobed corolla that is to 1 inch across, and deep violet, purple, rose or even white. Stamens yellow, protruding from tube; pistil, longer yet.	Flowers large funnels with 5 obscure lobes, of many colors but mostly red, white or purple or striped with these colors, may be single or double. Calyx of 5 parts is much smaller than the corolla but its segments about equal in length the fruit capsule which bears many seeds. Stamens 5 and attached to corolla.	Flowers in long terminal clusters, dark blue or white with 5-toothed calyx, 2-lipped corolla bearing 4 stamens which are united at the base and bear round pollen sacs. Pistil develops 2 2-lobed units that produce 4 smooth nutlets. Flowers of related *C. thyrsoideus* are bright blue.	Flowers are borne in heads and in this species the heads lack ray flowers. There are about a dozen flowers in a head with several heads grouped closely together. The branches bearing the heads spring from the axils of the leaves. Heads are about 1/3-inch across and the flowers are yellow.
Commonly reproduced by cutting started in sand under glass in summer in sun where drainage is good. Water should not be sprayed on leaves. A leaf spot and blackleg disease is common, and Mexican mealy bug is a pest that may be controlled by Lethane 440.	Flowers through much of the year if properly handled. Leaves cut in late March are cut with petioles about 1 inch long and stuck in moist, not too wet sand to start new plants. Seeds may be sown in warm, shallow beds of fine peat, leaf mold and sand, and seedlings should be potted, shaded and might flower by fall.	May be grown from cuttings, but use of seeds is probably simpler. Seeds are sown in fine pulverized soil either indoors or outdoors after frost danger and plants should bloom within 2½ months of planting time. Usually plants outdoors are thinned to 18 inches apart as they sprawl.	Usually is propagated by cuttings from the stems, which are made late in the growing season, rooted in sand over the winter in a moist situation and transplanted in early spring. The best temperature for luxurious growth is 60°-70°F. where there is plenty of moisture. Requires more than average care.	Propagation is usually by seeds and since the plant is an annual, it is not long lived, but cuttings may be made and life may be continued by this method. Cuttings are stuck into damp sand and root readily, but thrive best where the temperature is from 60°-70°F. and where the sun is not too strong.
The plant is grown commercially, not only as an ornamental in beds or in houses but for production of geranium oil, which is commonly used as a cheap substitute for or adulterant of oil of roses used in scenting soaps and perfumes. Distillation of oil from leaves by heat and pressure is usual method.	Plants can be rested by withholding water. Success depends largely on management of water supply, it being best to supply this from below. Plant is closely related to the gloxinias that have somewhat similar treatment but more startling flowers and leaves.	Plants grown in houses do best so far as flowering if night temperatures are between 45° and 50°F. Double-flowered plants do not produce seeds and must be propagated by cuttings made in the fall and carried through the winter as slips in which growth is not encouraged. Popular with geneticists and in flower boxes.	Commonly found grown in pots or used in hanging baskets or borders. New plants each year are superior to scraggly hold-overs. Highly susceptible to mealy bugs, which are kept in control by constant use of nicotine fumigation, sprays with nicotine, tar and fish oil and even by hand removal.	Grows so readily and easily that it is a popular house plant in widely separated parts of the world. It can survive with roots in a diminutive pot hung in a window, the stems with their attractive leaves drooping downward and providing color and design where it might not otherwise be found.

(Continued from page 475)

own house garden. It is strange to consider the varied group that a common interest in house plants will bring together; almost as strange as a dog club, a church, a library, a commuter train, a summer resort, or politics.

Now, for a few suggestions as to conditions that are most likely to suit most of your plant guests. The ideal night temperature for most plants is between 50° and 60°F. Remember, it is during the time of year when those temperatures prevail that you have to run the lawn mower most frequently. High night temperatures may well shorten considerably the length of life of a house plant. Usually, in winter, a plant near a window, but never over a radiator, is cooler than one away from the window. Room temperatures can safely range from 40° to 80° F., so long as the night temperature is lower than that of the day.

Light may be of as great importance as heat to your house plant guests. Bright, artificial light may be as effective as mild sunlight to some plants, but, to be effective, it should be present for at least 10 hours out of each day. This may account for the fact that sansevierias and aspidistras may do so well in hotels. Ferns and many of the foliage plants, and plants that flower over a short period, may be satisfied with the light that comes from a north window, or prosper in parts of the room just out of the range of direct sunlight. Most of our flowering plants, however, do best if, for a portion of the day, they can be in direct sunlight. African violets that a neighbor had difficulty in forcing into flower bloomed vigorously when it was suggested that she put them where direct sunlight could reach them.

My grandmother's geraniums bloomed in the kitchen where a teakettle or a wash boiler was in operation most of the time. These utensils were more effective in maintaining an ideal humidity for her plants than is the humidifier in the gas furnace in my basement. Ordinarily, however, humidity is not too critical a factor in raising house plants. Usually, the more humid the room in winter, the better it is for you, for your plants and for your furniture, although the piano tuner must grin with glee when he knows that a customer does not worry about humidity. Usually, it is not best to sprinkle the leaves of house plants with water. Merely see to it that an ample supply of water is available to the root system and the plant will probably take care of the rest of the situation. A new system has been developed for supplying roots with the necessary water. When a plant is put into its pot, the bottom of the pot inside may be covered with some burlap, cheesecloth or fiber-glass wicking. An end of the wicking is run through the hole in the bottom of the pot and hangs downward from that hole for an inch or so. The pot is then placed over a tray of water so that the wicking, but not the pot, is in the water. The plant is thus watered by filling the container. Incidentally, such a tray of water may be valuable in helping maintain the proper humidity for the room, for the plant and for you.

Since plants may be more sensitive to air pollution than are human beings, it may be well to maintain them as monitors on the air's purity. If the lower leaves of plants turn yellow and drop off in too great abundance, or if carnation flowers close up within 6 to 10 hours after they have been kept in a room, it might be well to investigate the purity of the air. Fans, radiators or strong drafts may remove so much moisture from nearby plants that the plants cannot survive. While plants do free some small amounts of carbon dioxide into the air at night, the amounts are negligible, and if flowers in a sick room are to be removed for the night, they would best be put into a cool room where their deterioration will decrease and their lives be prolonged.

Plants, like animals, may need some feeding. Of course, they manufacture most of their food, combining water and carbon dioxide from the air in the presence of their green parts. But other foods may help some plants. Usually, one can buy commercial fertilizer designated as 4-12-4 or 5-10-5. A spoonful of either of these applied to the soil in a 5-inch pot with water, three or four times a year, should be all of this kind of feeding that is necessary. Little value comes from adding tea or coffee to the soil of a potted plant. Too much fertilizer may cause the foliage to turn yellow, but the same symptoms may develop if the light is poor or the soil is too wet. Any tendency of the foliage of a house plant to die from the base upward may be taken as a symptom that something is wrong. If it happens to one plant, you need not be too concerned. If, however, it happens to many, it might pay to investigate.

In some situations, plants may tend to grow too rapidly, become spindly or generally to take on unattractive shapes. Such plants may be helped by pinching back their growing points. Geraniums, coleus and begonias are frequently helped by this practice. The pinched back portions may sometimes be used for the propagation of new plants. Suggestions as to the method suitable for different plants are given in the chart section of this article. In general, such plants as sansevieria and Rex begonia are propagated by leaf cuttings, while leaves and petioles are more suitable with tuberous begonia and African violet. Stems with buds are used as cuttings with German ivy, English ivy and some others. In poinsettia and geranium, it is sometimes the practice to bind bits of sphagnum moss to the stems at intervals at the joints. This moss is kept moist for some time until the stem develops roots at these points. Then, the stem is cut and the rooted segments set out as new plants. Layering is simple with geraniums and may be effected by bending a stem of a growing plant down and holding it with a weight close to the soil in a new pot. Eventually, roots will form at the point of contact. The stem may then be cut free from the parent plant and the new plant allowed to live an independent existence.

Insect pests and fungous diseases are the bane of the existence of many house plant lovers. In our home, we have found it best just to avoid trying to raise those plants that suffer from such things. We have enough species that are free from them to supply our needs.

Impressions from the Wilderness

By ROBERT MARSHALL

WRITTEN more than twenty years ago, this article is from an unpublished manuscript only recently found among the papers of one of America's outstanding conservationists who at the time of his tragically early death on November 11, 1939, in his thirty-ninth year, had already become a major prophet of the wilderness-preservation movement as we know it today. An explorer in the Adirondacks (where, with his brother George and Herb Clark, he was first to climb all 46 of the peaks above 4000 feet in elevation), in the Cascades, the Bitterroots, the Flatheads, the Missions, the Selkirks, and in the hitherto unexplored high mountains and deep canyons of the Koyukuk drainage in North Central Alaska, he had also established a record of more than 200 walks of 30 miles or more in one day. A trained forester and a land administrator in the Bureau of Indian Affairs and the U.S. Forest Service, he was also a noted writer — author of two books, *The People's Forests* and *Arctic Village*, as well as numerous contributions to magazines and journals. His paper, "The Problem of the Wilderness," in the *Scientific Monthly* for February, 1930, and his article, "The Universe of Wilderness is Vanishing," in *Nature Magazine* for October, 1937, were of decisive importance in the preservation movement, and were definitive in their interpretations and expressions of wilderness appreciation. Similarly interpretive and expressive, these earlier "Impressions from the Wilderness" will be valued as an enrichment of our understanding both of the wilderness and of the man for whom the 950,000-acre Bob Marshall Wilderness Area in Montana is named. The wilderness of which Bob Marshall wrote in this article — using names then current — is now the 1,581,200-acre Selway-Bitterroot Wilderness Area, comprising parts of four national forests in two States — the Bitterroot National Forest in Idaho and Montana and the Clearwater, Nezperce, and Lolo Forests in Idaho.

AS A BOY I spent many hours in the heart of New York City, dreaming of Lewis and Clark and their glorious exploration into an unbroken wilderness which embraced three-quarters of a continent. Occasionally my reveries ended in terrible depression, and I would imagine that I had been born a century too late for genuine excitement.

In subsequent years I began to appreciate that there still were opportunities for outdoor adventure if one looked hard enough for them. So I decided to make the best of what wilderness remained, and browsed among the most remote spots I could discover in the Adirondacks, the Cascades, the Bitterroots, the Flatheads, the Missions, and the Selkirks.

Meanwhile my friends varied in their opinions. Some held that I was merely taking an abnormally long time to outgrow the romanticism of childhood, while others insisted that I was chronically unbalanced. But when I went beyond innocuous mountain wanderings, and argued against the continual decimation of the last remnants of the wilderness, both factions united and solemnly asseverated that it was ridiculous for the whims of a few quixotic anchorites to obstruct the golden path of progress.

"Think how many more people," they would always say, "can enjoy the woods if you open them to autos than can ever benefit from them by this Daniel Boone stuff of yours? We can't lock up a lot of valuable natural resources just to cater to your selfishness. You must look at the matter from a broad, common-sense basis."

Yet to them, despite all their practical wisdom, certain doors of sensation were entirely shut. They never felt the need of the unique esthetic stimulations which the wilderness alone can provide. They never sensed the value of being entirely independent physically. They never discerned that a person might die spiritually if he could not sometimes forsake all contact with his gregarious fellowmen, and the machines which they had created, and retire to an environment where there was no remote trace of humanity.

But I knew very well that for me, and for thousands with similar inclinations, the most important passion of life is the overpowering desire to escape periodically from the strangling clutch of a mechanistic civilization. To us the enjoyment of solitude, complete independence, and the beauty of undefiled panoramas, is absolutely essential to happiness.

This necessity of getting away from the stifling artificiality of civilization cannot be explained to those who have never apprehended the longing for the wilderness, yet it is quite as genuine as the more conventional yearnings for love and knowledge.

It is probably futile to defend esthetic necessities by logical exposition. Perhaps, however, the record of a few impressions from one wilderness journey will help bring understanding of this lust for the primeval. In this hope I shall picture briefly a few typical experiences on a walk through the Selway National Forest in Idaho, heart of the biggest wilderness left in the United States.

— II —

THE first snow of September was falling steadily along the lofty Lolo Trail. The path, tramped by generations of Nez Percé ponies during the annual pilgrimage to and from the buffalo country, was too muddy to show white so soon, but the grass along the sides and the surrounding trees were already blanketed. Under this cover flowers, berries, mosses, highly pigmented rocks, everything that made the forest warm and colorful, had vanished. In a few hours the season had jumped from late summer completely over autumn, and had landed frigidly in January.

The trail jogged up and down along the skyline, traversing old burns where barkless lodgepole pines stood gauntly in the fog. This was so dense that visibility was limited to little more than a hundred feet. There was no chance to see where one was going; no

PHOTOGRAPHS BY K. D. SWAN, FROM U.S. FOREST SERVICE

Of such primeval beauty is the wilderness made. This white pine forest is in Idaho near Elk Butte and in country similar to that described by Robert Marshall.

chance even to anticipate the oscillations of the route. One simply traveled in faith along the only perceivable path.

As the afternoon drew to a close and my destination, the lookout cabin on Castle Butte, became overdue, I stopped in the soggy twilight to look at the map, and observed with concern a discrepancy between my imagined position and the compass. With a cold, shrinking reaction in the stomach, I went over in my mind all the instructions, every fork in the trail, and could not recall a single dubious turn. Yet here I was, almost at timberline, soaked and chilled through, and the only shelter within fifteen miles lost somewhere in a howling snowstorm.

On just such a night, a century and a quarter before, Lewis and Clark had been camped here, two years from the nearest settlement, winter closing in, food almost gone, meat unprocurable even by the best hunters, bodies fagged from months of the stiffest hardships, a thousand unknown possibilities of disaster ahead, and nothing for a destination except a bleak ocean shore inhabited only by savage and perhaps hostile tribes.

And I was worrying about a single miserable night!

But this cheerful comparison did not decrease one whit the delight I felt when a substantial log house suddenly loomed through the snow. A loud knock brought Hank Shipman to the door, and in a few moments I was seated stiffly by the stove, peeling off dripping garments and blessing the ingenuity of Prometheus. With all the unique charm of sub-alpine hos-

Virgin white pine, three hundred years old, in the Clearwater National Forest country of Idaho.

U.S. FOREST SERVICE PHOTOGRAPH

The west front of the Bitterroot Mountains, with a wilderness growth of Englemann spruce in the foreground and Grave Peak in the distance.

pitality, Hank made me welcome, and shortly added to this kindness the more tangible benevolence of fried grouse, hot biscuits, and cup after cup of scalding coffee.

After supper, while a blizzard raged outside, we sat together and talked in the warmth of unanticipated friendship — and a red hot stove. It was exhilarating to calculate that the nearest settlements were 65 miles to the west and 97 miles to the east.

Just before retiring I went outside. The storm had passed, and a brilliant silver moon was shining nebulously upon a hushed and all-encompassing expanse of fresh snow — mid-winter, and something unearthly about it with the unsubstantial moonlight, the arctic landscape, the weird silence, and only the sky above. Surely this was not the same world as that of twentieth century machinery, squalid tenements, subways, concrete roads, country clubs, and 23 million automobiles. For one night at least, upon this mystic mountaintop, I had left that existence completely, and was living in a universe beyond the influences of civilization.

— III —

GRAVE Peak is the highest point in the Selway Wilderness. Orographically it belongs to the Clearwater Mountain system. Dendrologically it is covered with lodgepole pine, Engelmann spruce, alpine fir, whitebark pine, and a few specimens of the rare Lyall larch. Biologically it supports innumerable herds of elk, multitudes of deer, quantities of black bear, goats, coyotes, martens, and rabbits, and a few vagrant grizzlies. Etymologically it honors old Leo, a Nez Percé hermit, who left his footprints on much topography in the vicinity, and his bones on this rocky sarcophagus.

From Elk Summit the climb commences through pleasant although unsensational woods. After about six miles the real scenery begins. The trail passes tourquoise tarns set in granite and beargrass, from which streams cascade with a freshness only found at seldom-roamed sources. Dazzling white crags are all around, between which the path rises steeply until it crosses the timbered skyline at Friday's Pass. A mile away to the west Grave Peak towers. The trail drops and rises again through an open forest, the loftiest that the extreme climate above 8000 feet permits. When it crosses a second ridge and emerges on a bleak north wall, overhanging half a dozen source ponds of the Lochsa, all but a few extremely stunted larches have vanished, and the last scramble is up bare rock.

In the sweeping panorama, which stretches 15 miles to the serrated wall of the Bitterroots, and 75 miles in every other direction, the dominant impression is of immense wildness. There is not even a single remote trace of civilization. Needlelike peaks rising unscalably into the sky, spacious plateaus suddenly dropping into gloomy gorges, wooded basins meeting on irregular fronts with snag-strewn burns, deep blue ponds and bright parks alleviating the harshness of granite, goats moving with poise and dignity along ledges impending

over air — all these are as unaltered as in the ages before even savages had ventured to this igneous upthrust.

The wind blew so fiercely that after half an hour I was glad to drop down a thousand feet into a high park studded with azure lakelets. Threading my way along their grassy shores, I scared up half a dozen elk, which trotted off tamely for a few hundred feet. From this park I climbed three more pinnacles which gave surprising views of previously invisible canyons, and then returned back over Grave Peak.

Just before coming to Friday's Pass I noticed a pair of grizzly cubs feeding on the hillside above me. I stood watching their unconcerned antics with great interest, until all at once I heard a crashing noise behind. Wheeling around, I saw a colossal grizzly, not thirty feet away, charging straight at me. "Theirs not to reason why, theirs but to climb or die," so I started on the run for a whitebark pine which seemed to offer the closest haven. Up I went, faster than my unaerial anatomy had ever progressed toward Heaven. Up I went for about ten feet, when in my haste I stepped too clumsily on a dead branch. It snapped and I flopped. While gravity was doing its worst, I recollected the testimony of old hunters that bears will not molest people who feign death. It seemed a slim chance, but not half as slim as wading into that mass of ferocity with bare fists. So I landed and lay. It seemed as if I reposed for aeons. About the dawn of the Cenozoic Era I heard strange rumblings above me, and concluded that another geological upheaval was in progress. I opened my eyes and looked up the hillside to see three bears disappearing over the ridgetop.

It was a terrible blow to my self-esteem. The old mother had no more interest in me than in the tree out of which I had tumbled. It was only the geometric principle that three points determine a straight line, and the accidental fact that I happened to be the middle one, which caused all the furore. If I had stepped five feet to one side, the mother no doubt would never even have blinked at me. But of course one does not calculate in inches with a grizzly charging.

Western Dawn

By RICHARD G. BEIDLEMAN

Out of the black sky,
Clean, unseen,
A new day sweeps.
Sun on the dark hills
Softly warms
A land that sleeps;
While meadowlarks in trebled choir
Splash the morning with sparkling fire.

— IV —

It was the last evening of my journey, and I was sitting quietly in the dusk that had gathered in the narrow valley of Big Sand Lake. The somber mountainsides, covered by parallel, overlapping spires of dark green spruce and alpine fir, rose abruptly from the very edge of the water to an indefinite region where they merged with the fog. The lake was one gray shadow, except for the bright, salmon-colored horns of a giant bull moose, which slowly wallowed through the lilypads just off the densely wooded shoreline. Everything he did was deliberate and had a dignity appropriate to an environment which measured changes by the century instead of the hour. A gangly-legged calf was splashing in the shallows and looking up every now and then with curiosity. Night birds circled; the last mosquitoes of summer hummed their farewell song; a gentle wind rippled the placid water. The old bull turned slowly and disappeared into the black forest. The calf lingered uncertainly for a few moments, then uttered a queer snort and followed. The trees across the lake lost their identity, and darkness imperceptibly had fallen, as on millions of evenings before the intrusion of man.

★

Some Notes on Ornery Ornithology

By BURNHAM EATON

The world in which a sparrow lives
Is cluttered up with relatives
And others, rough but hardly bolder,
For whom he keeps a chippy shoulder.
Though sparrow life is sociable
No asset is negotiable;
With snacks a penny's worth nutritious
He waxes vocally officious
And crumbs of bread bring on a spasm
Of fifty-cent enthusiasm.
Intruders twice his size or more
Get what they never bargained for:
A piece of effervescent mind
Italicized and underlined.

They Call Them "Xylem-o-Philes"

By BOB FORBES, W.C.S. No. 151

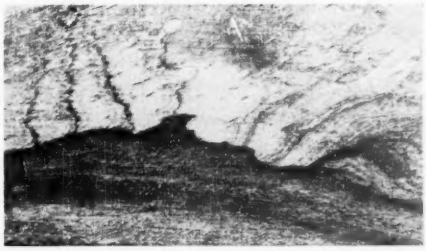
ARCHIE Wilson, Harold Nogle, Henry Dentzman and two companions, all leading business and professional men of their communities, certainly did not look like dignified citizens when they pushed their way into the woods of Dismal Swamp one summer afternoon. The day was almost the season's hottest and the men looked it. Rattlesnakes and copperheads in the brush made it imperative to beat sticks in the path before advancing. Marshy ground frequently necessitated long detours.

This territory, extending for 1000 square miles between Virginia and North Carolina, was described by William Byrd, an early colonial governor, as a "filthy Bogg." But the five adventurers could see their surroundings only as George Washington did. The father of our country, who there surveyed a canal, which to this day bears his name, called the swamp a "glorious paradise."

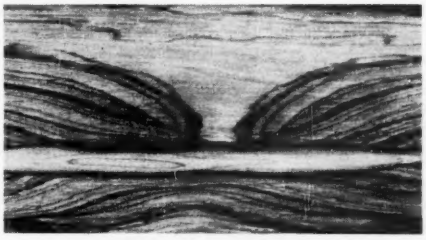
Hardships increased as the men hiked deeper into the swampy forest. But all five were members of the Wood Collectors Society, to whom such irritations as biting flies, sun stroke, getting lost and almost drowning are all a part of the pleasure of gathering rare specimens of woody plants.

The exploration of Dismal Swamp yielded only some pieces of wild grape and a few cypress knees, but the wood collectors' vacation trip was a great success. Poison ivy, blackhaw viburnum, common sweetleaf, sourwood, crossvine, switch cane and other woods were gathered on the 1000-mile journey to and from the swamp. Several times during the 10-day hegira from civilization, the wood collectors had to sort and discard from their treasure trove. A passenger car can only haul so much, they found.

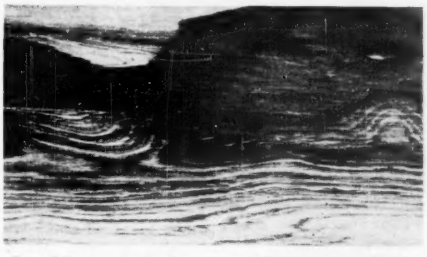
A "seascape" in a specimen of lignum vitae in the collection of Bernard Hildebrand.



Hildebrand specializes in rosewood. Above he sees storm clouds and lightning around a western tablerock outcrop.



This specimen is felt to picture a farm fish pond among contour-plowed hills.



In this is seen dawn on the mountainous California seacoast with a fairly calm ocean.

"We managed to include several terrapins for my boys at home," said Harold Nogle, society treasurer and member No. 3 since time of establishment.

Such strenuous trips in different parts of the country are common experiences to dyed-in-the-wool wood hobbyists, who have graced their mania with the title "Wood Collectors Society," founded on Easter Day, 1947. In the past four years, the society has grown to a total membership of 170 in 31 States and 14 foreign countries. Members are now found from Holland and England to Ceylon and the Philippine Islands; from Ecuador and Chile to Australia and South Africa.

The W.C.S., as the international organization is known to its members, is still growing as word of its existence becomes more widespread. They are "xylem-o-philes," or lovers of wood.

These scattered victims of "xylemitis" meet occasionally in large American cities. Recent gatherings were held in Cleveland, Berkeley, California, and Chicago. In addition, a W.C.S. member in the United States may expect fellows in wood to drop in on him at almost any time, whether he is in Glendale, Arizona; North Branch, Minnesota; Lewiston, Pennsylvania, or Missoula, Montana.

Perhaps the most intimate tie binding these world-wide friends is a monthly newsletter, which sometimes looks

Wooden samples of a handy size are stock in trade of W.C.S. members for trading purposes, identified in this way. These from the collection of Orville A. Oaks come from far places.

like a professorial paper, sometimes like the bill of lading at a warehouse. The latter aspect is because of numerous lists of wood samples that members want to share with each other for twenty-five cents per swap, the blocks being standardized to one-half, by three, by six inches.

Erudite discussions in letters take up almost any subject related to the tree and wood hobby. Recent issues contained a bit on botanical nomenclature by member Emanuel Fritz, of the University of California School of Forestry, and another article by Norman B. Higgins, who advised on the seasoning of wood.

Nearly every issue of the letter contains tall tales about wood-collecting expeditions in different parts of this country, and elsewhere around the world. W.C.S. member William Pond, of Portsmouth, Virginia, a chemist by profession, sings the praises of Dismal Swamp as if beating the drums for the Chamber of Commerce. His campaign has met with success in luring a number of brother collectors to visit the area.

Many wood collectors brag in the news-letter about unique finds, making society brothers and sisters envious. George L. Miller, of Te Awamutu, New Zealand, did that successfully in a story about finding the wooden rose of his island.

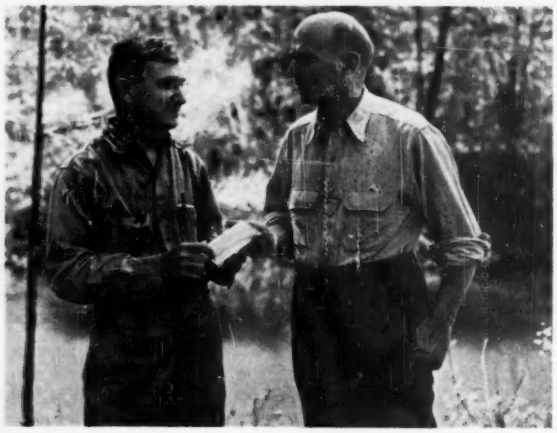
"Wooden roses are formed by a rare parasitic plant growing on the roots of certain trees on North Island here, and nowhere else in the world," relates wood addict Miller.

"Our expedition seeking wooden roses in the tree and fern-clad high country of the 'bush' had to rely on the woods-lore of a Maori native for success. But we located a bunch of the growths at the base of a lancewood tree, exposed up to 10 inches above the forest floor.

"After cutting the bunch from the host tree, we had to pack it to our automobile and trailer — no light job as some of the growths weighed more than 100 pounds each. When we got home, the next step in realizing our reward took several days. Each fasciation had to be boiled in water for several hours and then scraped to remove the blood-red flesh of the parasite proper.

"Then, and only then, could we see if any wooden roses were in the lot collected, for sometimes they may be decayed or distorted. But sometimes the labor involved is rewarded with a perfect rose flower in the wood, delicately shaped and with fine lines on each petal."

C. D. Gilbert, a collector writing from his home in Houston, Texas, entertained fellows



At the W.C.S. founding Harold Nogle, left, talks with Arthur Koehler, recently retired from the U.S. Forest Products Laboratory. Mr. Koehler, sleuthing with wood, solved the mystery of the Lindbergh kidnapping.

Orville Oaks is a master of wood turnery. Here are displayed some of the variety of woods he has turned into ornaments.

around the world with a description of an elaborately carved Irish shillelagh received from County Killarney.

"This jet-black wood of the blackthorn (*Prunus spinosa*) is so heavy that it sinks in water," relates Mr. Gilbert. "No wonder it will put you under the table, if it comes in contact with your head, as fast as sloe gin distilled, using another blackthorn product — berries, which are sometimes called 'sloes.' "

A pleasant surprise is in store for wood nuts who place their blocks in a "black light" contraption, reported member Ray Cottrell. "Black locust reflected a bright glow which lit up a dark room, when I first tried 'black light.'

"Different species of sumac were magnificent with various shades of fiery golden streaks on a deep blue background. Perhaps 'black light' is of value in identification.

"The indescribable color effects are truly breathtaking, though. Anyone who has not had this delightful adventure should try it."

The next issue of the letter contained a plug for a "black light" machine, with price-list included, manufactured in another member's home town.

Another news-letter feature is the review of every new book about woods or trees. Wood collectors, when they are not searching for or working with their material, enjoy reading about it. There are many bibliophiles in the society, and some literary members who discover or think up written gems extolling their hobby.

The W.C.S. secretary found that the Roman naturalist, Pliny, said: "Trees afforded the first inducement to the barbarous tribes of Gaul to cross the Alps and spread themselves over Italy." Shakespeare had a word for Italian cypress in *The Taming of the Shrew:*

"In ivory coffers I have stuffed my crowns;
In cypress chests my arras counterpoints,
Costly apparel, tents and canopies."

W.C.S. No. 25, Wilmette, Illinois, is Orville A. Oaks, a teacher who breaks into the letter often with scholarly pieces on such subjects as "Sacred Wood of the Oriental Gingko Tree," or "Cider Tree of South Africa," a tree that yields a fermentable liquid for native binges.

Most collectors are expert craftsmen and became interested in their fellowship because of a love for woodworking. These men have numerous objects-of-art they have fashioned on the workbench, besides swaping samples, which are common ties around the world.

The late Frank Avery, a W.C.S. member almost since the day of club founding, accomplished the seemingly impossible task of making things of beauty from the common sagebrush around his Idaho home. Member Leo Kische, a high-school teacher of manual training, makes serviceable articles from the plentiful wood waste obtained at sawmills near his home in Ewen, Michigan. Particularly ingenious among Mr. Kische's products are bird houses of northern white cedar slabs, turned out on a production basis to supplement his public-school salary.

W.C.S. member Bernard G. Hildebrand gives most of his attention to wood of one tree species, black rosewood, which exhibits wide variations in figure and color. The darker and stabler colors of his wood, such as black, brown, purple and red, usually predominate; but more delicate shades, like pink, blue, green, orange and yellow, are sometimes present.

"So far, I have roughed out 250 pieces of this wood, no two of which look exactly alike," explains Mr. Hildebrand. "Half of these have received a finish, often to reveal startling pictures. By using a little imagination, a person can see mountains, seascapes and sunset scenes. I have labeled some of my blocks with such names as 'Mountain Lake,' 'Storm Clouds,' 'Contour Farming' and 'Dante's Inferno.' "

Almost all collectors have a great deal of wood finish in and around their homes, not just on the workbench.

Despite much attention (Continued on page 498)

The Friendly Jumping Spider

By VEGA IHSEN

Illustrated by the Author

PERHAPS the most social-minded and certainly the most downright friendly of the spiders is the little jumping spider of the Salticidae family.

One of these, a stocky, grayish-black spider with the bits of color on his upper side, is surely a familiar sight to most people. His favorite haunts for indoor promenades are usually window panes and woodwork. There he cavorts happily, half running, half jumping across his broad plane of action.

A number of times, on warm spring days, I have been slightly startled by one of these spiders who, tiring of his apparently aimless wanderings about a window pane, leaped playfully on my drafting board. Perhaps the spider wanted company to help to pass the long afternoon hours.

I have my own art studio and work alone. Perhaps this fact is fortunate for me. I am certain that if I shared it with any co-workers, I would be marked for a straight jacket in short order. But, what would you do if a little dog came squirming up to be petted? Not that I exactly pet spiders; but, they are no less friendly — in their own way!

The small spider runs happily down my drafting board, adroitly side-stepping fresh ink that I have just applied. Then he pulls up about two inches short of a 30-degree triangle and waits. This is my cue to shove the point of my lining pen menacingly — but gently — towards him.

The tiny spider braces himself and slowly circles the advancing pen. Then, when I thrust the pen suddenly forward, he leaps a good two inches away, whirls around, side-steps, backs up, advances slowly, in the process generally exhibiting some of the finest boxer-like footwork imaginable.

The little game continues. Again my pen slowly pursues the wary gray spider. But, now, to alter matters a bit, I veer the pen off in a direction away from the spider. Startled and confused, and doubtless thinking, "Hey, this isn't cricket!" the little spider starts to run and jump after the retreating pen point.

All of a sudden I stop the pen. The spider stops simultaneously, almost bumping into the pen. Then he paws the board a little, as if to plan the next move.

About this time I recall, rather abashedly, that I am supposed to be working on a mechanical drawing. So I send my little eight-legged friend scuttling with obvious disgust to the top edge of the drawing board. There he disappears over the end of the board, but immediately reappears. Intrigued by this unusually friendly little soul, I begin tapping my fingers up the

board and to the left. The spider watches and turns. Soon he begins to follow the tapping fingers, stalking at a modest distance in their wake.

My fingers suddenly reverse their direction. The spider leaps in retreat and scurries half way up the flourescent lamp base. I go back to my drawing work; and momentarily forget the little fellow.

But, not for long! There, (no doubt standing on tiptoe) on the warm metal light shade of my lamp, the tiny, inquisitive creature is regarding me from a distance of about four inches! Before I can register astonishment over the fact that he has traversed some four or five feet of angular lamp spokes to gain his vantage point, he leaps in the direction of my nose. But, he misses (due to my dodging, not to his bad judgment of distance), and lands on my drawing board.

There he looks at me rather reproachfully, waiting to see if I will play tag with him any more.

But, not today. I must finish my drawing! So, gently coaxing him on a ruler, I transport the little spider back to a windowpane across the room and leave him to mope by himself. As I leave, he is no doubt preparing plans for the long excursion back to my drawing board.

In my own experience, I have never before "known" such friendly, intelligent little creatures, at least this small. Almost all insects will hurry away either in desperation, fear, or plain disinterest. Even other members of his own spider family are not friendly. But, the tiny jumping spider possesses such an uncanny, human inquisitiveness and a sense of humor, that it merits more than a passing glance. To my way of thinking, this small, insignificant looking little spider has a pretty high I.Q.!

Natural Scientists Needed

By BEATRICE H. SIMMONS

This article was prepared specially for Nature Magazine by Mrs. Simmons of the Vocational Consulting and Testing Division of Polytechnic Institute of Brooklyn. It has been carefully checked by a number of leading scientists active in the fields of endeavor discussed, and is presented in the hope that it will be of assistance to those who may choose careers in the natural sciences.

THERE is an intimate and fundamental relationship between the welfare of a nation and its understanding of and wisdom in using its natural resources. Such understanding and wisdom is passed on from one generation of natural scientists to the next, much as the torch was handed from one athlete to another in the ancient Olympian games. In our concern with technological development in the last century, there have been too few trained to carry on the torch of the natural sciences; too few trained in the conservation and proper use of natural resources. This shortage of trained natural scientists is now so great as to make up more than one-sixth of those occupations which have been declared to be in critical shortage by the government. Young people are needed to carry on and add to the accumulated knowledge of earth, air and water, and the plants and animals that are dependent upon them for life.

Ten of the natural science occupations listed as being in critical shortage in the nation are occupations in which readers of *Nature Magazine* are interested, and it is from such groups as *Nature Magazine* readers, 4-H Club members and the Boy and Girl Scouts of America that many of our future natural scientists will come.

In addition to interest in a natural science occupation, the student who hopes to make his maximum contribution (and thus to derive maximum satisfaction) should know the general and specific qualifications for the various related science occupations. If he is able to compare his own interest, achievement, and personality pattern with available information on the requirements for careers in which he is interested, he will be able to move ahead toward his vocational goal with little waste effort.

Most science occupations require long in-school training. In fact, for all of the occupations listed below, except farming, the four-year bachelor's degree in a specialized field of science is only a beginning. For full professional status, the student will want to spend one to four years beyond his bachelor's degree getting his master's or doctor's degree in his special subject area.

Since scientific training is long and arduous, young people who want to enter these fields will need to have high scholastic aptitude. The closer their school marks are to the top of their classes, the better are their chances of having the required scholastic aptitude for long years of college training. Although good work in all subjects is important to the future scientist, excellence in science courses is most important. If the student has a lively curiosity, is interested in how things grow and what "makes things tick," if he does better than average in school and is especially good in science, he may one day be one of the highly trained scientists our country so badly needs.

There are other qualifications, too, for success and happiness in natural science occupations. One is patience, the ability to work long and painstakingly to be certain of accuracy of observation. Another is willingness to work alone, as scientists do laboratory research and spend long hours with only their pet bacteria or seedlings for company. A third is objectivity, the ability to see and state facts without being influenced by groundless preconceptions. Such additional skills as ease in writing, or the ability to work well with people, can be used by the natural scientist. Most scientists have to write concise and meaningful reports of their findings. Some specialize in bringing the results of their and their associates' researches to the general public in articles of interest to laymen, to students through high school, institute or college teaching of science subjects, and to farmers through extension teaching and rural education.

The salaries in the natural science jobs have been low, considering the long training necessary for competence, except for those of scientists who work for large industrial, mining or agricultural concerns. Although in the future we may hope for higher salaries due to the evidence of the national need for these men, the student must plan on deriving his chief pleasure from the nature of the work and cannot, at present, expect large financial rewards.

Each of the brief descriptions below tells what the various workers do in the ten occupations listed. The occupational titles come, for the most part, from Greek or Latin words, and because the origin of these titles is so illuminating, the derivations have been included. If the student finds his interest stimulated by the work in any of these fields, he may wish to read some of the pamphlets listed at the end of the article. These booklets give a far more detailed picture of the occupations

than we can here. School and public libraries should have many of these booklets on their shelves.

AGRONOMIST
(from the Gr. *agronomous* —overseer of public lands.)

AGRONOMISTS study the technical phases of crop production, including study of and research concerning soils, plant breeding, weed control and climatic factors. In such government agencies as the Soil Conservation Service, Indian Service, Bureau of Reclamation and Bureau of Plant Industry, they do laboratory research or field work. Their duties are often highly specialized as, for example, research concerning legumes and forbs used for forage, or the establishment of crops and turf for conservation purposes. Agronomists also do such farm extension work as developing regional programs in the various phases of their discipline. Some are employed by the larger seed and grain companies, fertilizer and chemical producers, and other agricultural enterprises. Others teach in agricultural colleges and in universities.

ENTOMOLOGIST
(from the Gr. *entomos* — cut in, so called because the Greeks saw the insect as nearly cut in two.)

THE entomologist studies insects in their relation to man, especially in their role in crop production, disease, fish culture, animal and poultry husbandry, He is concerned with the control of insect pests and with the study of their life habits. Although all entomologists study insects, there are specializations within the specialization. Some, called economic entomologists, study insects, or a particular insect such as the Japanese beetle, in relation to crops and man. Others, physiological or systematic entomologists, concentrate their researches on insect anatomy, classification and identification of insects, or the functioning of the insect organism. In government agencies the entomologist may test insecticides, test and develop insect-resistant crops, collect insects in the field and identify them, or conduct research on the insects that produce disease in man and domestic animals. Another form that specialization may take is according to the environment of the insect — insect pests of the home, such as roaches and bedbugs; insects of the farm, such as poultry lice and horse flies; insects important to the maintenance of wildlife. Although most entomologists are employed by the government, they work also for museums, natural science emporia, colleges and chemical producers.

FARMER
(from Middle English *ferme* — to rent or lease.)

WE HAVE progressed far from those of our ancestors who could not own land, but must rent it. Now the great majority of the almost one-fourth of our population engaged in farming owns its land, and the increasingly complex tools with which to develop it. Although all farmers are engaged in growing plants or animals, it is up to the individual farmer as to whether he will be a specialist in one or two products or will engage in general all-around farming. Whatever his choice, he will need to be a resourceful and observant individual, capable of managing his own and others' time, able in the ways of business and keen in the ways of Nature. Good facilities for farm education, by extension courses and residence courses in agricultural colleges, make it possible for those who so desire to be scientific in their production of peas, beef, earthworms, or whatever. Research studies show a steady gain in average income from the farmer with less than elementary school education up to the farmer with a degree from an agricultural college. U. S. and State Departments of Agriculture have a great deal of material available free to individuals who are interested in farming as an independent, wholesome and gratifying way of life.

GEOLOGIST
(from the Gr. *geo* — earth, *logos*, word or discourse on, study of.)

GEOLOGISTS study the basic material of the earth, the rocks in their various formations and the mineral and fossilized organic materials that they contain. There are three main specializations in geological work; economic geology, which is concerned with the discovery and exploitation of such earth materials as coal, oil, and ores, and with the study of rock formations in relation to proposed structures; physical geology, which is the study of the formation of rocks and earth and the effects of weathering and other physical action upon geologic structures; and historical geology, which endeavors to understand the historical development of rocks and the fossilized inclusions of the earth's crust. Physical and historical geologists teach and do laboratory and field research for colleges and museums. Economic geologists work in such Federal agencies as the Geological Survey and the Bureau of Reclamation. They also find employment with the oil and mining industries and with construction firms.

GEOPHYSICIST
(from Gr. *geo* — earth, Gr. *physis* — nature.)

THE geophysicist applies the principles of physics, the study of matter and energy, to natural phenomena. Nine specializations of this comprehensive science are listed by the American Geophysical Union — geodesy, earth surveying; seismology, the study of earthquakes; meteorology, study of the atmosphere; terrestial magnetism, the study of the magnetic and electric phenomena of the earth and its atmosphere; oceanography; volcanology; hydrology, the study of rainfall; tectonophysics, which applies physical principles to the study of the structure of the earth; and geophysical exploration. Another common method of subdividing the practitioners of this science is by the use to which their study is put. The two main groups, from this point of view, are the theoretical geophysicists who do research, often on an international scale, to advance man's knowledge of the earth's properties, and the practical geophysicists, whose research and field work is used by industry to determine the location of valuable mineral deposits. More than

three-fourths of all geophysicists fall into this latter classification, and are hired by oil companies or establish private consulting firms. Others are employed by the government and armed forces, by colleges and universities and by research institutions.

MICROBIOLOGIST
(from Latin *mica* — crumb or grain, Gr. *bios* — mode of life, *logy* — word or discourse on, study of.)

The microbiologist identifies and studies micro-organisms of various farm products. He is frequently employed to study the control of harmful micro-organisms or the propagation of those micro-organisms that are beneficial to man, his food plants, or animals. He may specialize in micro-organisms affecting farm produce, food spoilage or soils. When employed by the government, the microbiologist may study such processes as the decomposition of plant and animal materials, the production of ensilage or the formation of composts, all of which are greatly affected by the microbial population. The field of microbiology is itself a specialization of the larger field of bacteriology.

PARASITOLOGIST
(from the Gr. *parasitos* — literally, eating beside, or at the table of, another.)

The parasitologist studies the life history of plant and animal parasites to the end of controlling their effects upon their hosts. The economic importance of parasitic action may be judged by the fact that, in the late nineteenth century, three million sheep died annually in Britain from parasitic fluke infestation. Parasitologists do research in classifying parasites and understanding the complex life processes of parasites, which often develop special organs and adaptations for their dependent mode of life. They develop treatment for affected domestic or wild animals as well as biological or chemo-therapeutic means of eliminating parasites. The growth of such beneficial parasites as the parasitic hymenoptera, which lays its eggs on plant lice, is fostered. Parasitologists work for local, State and Federal agencies, for large animal product industries, pharmaceutical firms and research organizations. The master's degree is now considered the minimum training requirement.

PHYSIOLOGIST
(from Gr. *physis* — nature, *logos* — word or discourse on, study of.)

The physiologist studies the life processes of living organisms, plant or animal, and the reaction of plants or animals to various environmental stimuli. He seeks to interpret life processes in terms of physics and chemistry, applying the findings of these fields to his particular discipline. For example, he may study the effects of the physical environment on the storage of food products, or the chemical plant hormones and their effect upon the size of the mature plant. The physiologist may do research that aims at clarity concerning a life process, such as respiration or reproduction in a certain species; he may carry on controlled experiments to determine whether certain environments are beneficial or harmful to development; or, he may do educational or literary work to publicize the findings of physiologists. Physiologists are hired by educational institutions, government agencies, hospitals and the food and drug industry.

PLANT PATHOLOGIST
(from Gr. *pathos* — suffering, disease, passion, *logy* — word or discourse.)

The diseases and disturbances of plants are the particular field of study of the plant pathologists. Plant pathologists plan and carry out research to determine the causes of plant diseases, which may be due to a virus, bacterium, fungus or to some nonparasitic agent. In an effort to control plant disease, the plant pathologist gives consideration to the physical factors that affect the development and spread of disease. The chief employer of plant pathologists is the government. In Federal and State agencies the plant pathologists may do research, inspection and quarantine, and farm extension work. As his experience in the field mounts he may be assigned administrative duties concerned with the supervision and coordination of research or extension programs. As in other scientific occupations, the specialist may teach in colleges and universities or may be hired by commercial organizations.

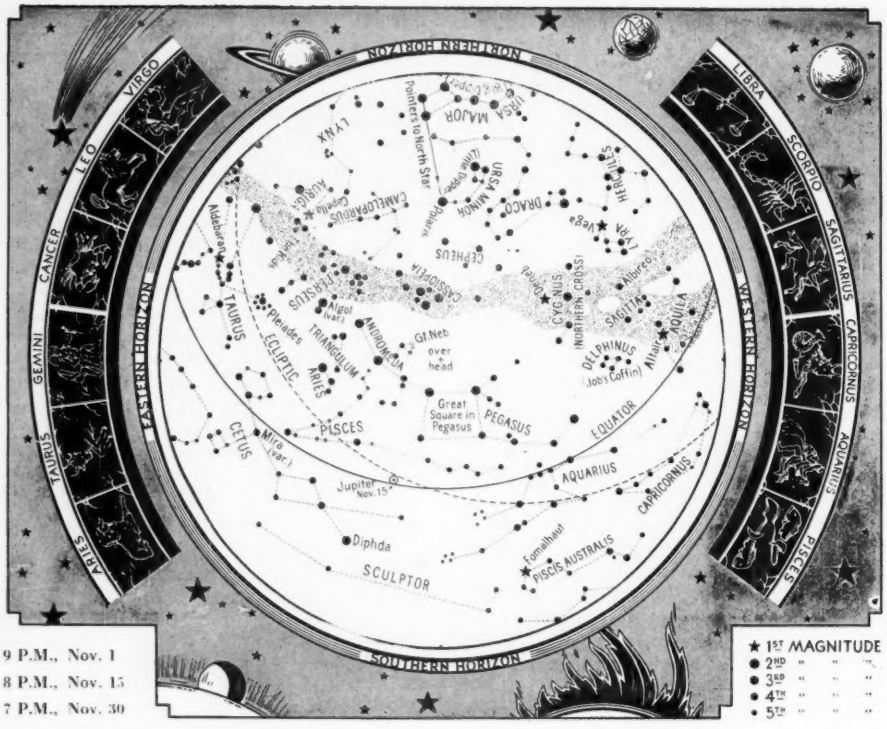
VETERINARIAN
(from the Latin *veterinarius* — pertaining to beasts of burden or draft.)

The present scope of the veterinarian's work is far more inclusive than was the original science. Now, the veterinarian is an animal physician and surgeon, as well as a protector of public health. He prescribes treatment to keep animals well, cares for diseased or hurt animals, inspects animal products intended for consumption as human food, and works with public health officers to control and eradicate animal diseases that are transmissable to man. He may specialize in a particular species of animal or a special group as, for example, thoroughbred horses or pets. Veterinarians work for such government agencies as the State and Federal Departments of Agriculture where they do meat inspection, research and disease control work. Veterinarians are commissioned by the Army and Air Force Veterinary Corps. Zoos and circuses employ veterinarians, as do agricultural colleges and schools of veterinary medicine. Most veterinarians, however, are in private practice in rural areas. The training calls for at least two years of pre-professional college study, plus four years of professional veterinary education, a total of six college years. There are seventeen schools of veterinary science in the United States.

SOURCES OF FURTHER INFORMATION

AGRONOMIST: Bear, Firman E., "What is Agronomy?" in *School and College Placement*, December, 1949. *Handbook of Descriptions of Specialized Fields in Agronomy and Soil Science*, National Roster, Superintendent of Documents, Washington, D.C., 1945. (.05)

ENTOMOLOGIST: "Entomologist" in *Biology Careers Chart-Manual*, Rice Research Associates, 1950. p. 36. *Handbook of Descriptions of Specialized Fields in Entomology*, National Roster, Supt. of Documents, 1945. (.10)(Continued on page 498)



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

In Autumn Skies

By ISABEL M. LEWIS

In the evening skies of the northern hemisphere we look each year for the return in season of old familiar friends among the stars and constellations. In the spring Regulus, in The Sickle in Leo, meets our eye. Bluish-white Spica in Virgo appears in the east. Gemini and The Pleiades are well over in the western sky. Soon Antares and all those brilliant stars in the tail of Scorpio are seen in the south and summer has arrived. We now see rising in the east, in turn, brilliant Arcturus in Bootes, to stay until well into the fall; Corona Borealis, the northern Crown; then huge Hercules; Vega in Lyra, and finally, embedded in the Milky Way, the Northern Cross, in Cygnus, at its top that giant among stars, Deneb or Arided.

In late summer and early fall the Milky Way stretches brilliantly across the heavens, from northeast in Cassiopeia in a southwesterly direction into Cygnus, where it divides into two branches, one passing through Aquila, the other through Ophiuchus to Sagittarius and Scorpio, now below the southwestern horizon. As Orion, Taurus, Auriga, and the Dog-stars, Sirius in Canis Major, Procyon in Canis Minor are to dominate the winter evenings, so the Great Square in Pegasus, Andromeda, Perseus, and Cassiopeia are dominating the evening skies in autumn. In the southern sky, in the constellation of The Southern Fish, we also see standing quite alone in late fall the brilliant star of first magnitude, Fomalhaut. So far south is this beautiful star that it is with us for only a brief period in the autumn evenings.

The Great Square in Pegasus is one of the largest constellations in the heavens. There are so few stars visible within the square that its outline stands out

clearly against the sky background. The star in the northeast corner does not belong to this constellation but is the star Alpha Andromedae, or Alpheratz, in the constellation of Andromeda. There are no stars of first magnitude in Andromeda but the three second magnitude stars extending in a curved line from Alpheratz in the northeasterly direction are the principal stars in the constellation of Andromeda. Alpheratz marks the head, Mirach, next, the breast, and Almach the left foot of the maiden who rests against the shoulders of the Winged Horse, Pegasus. According to the ancient legend, Cepheus and Cassiopeia were the king and queen of Ethiopia, and Andromeda was their daughter. The queen was very beautiful but vain, and had the audacity to compare herself in beauty to the sea-nymphs. So much did this enrage the sea-nymphs that as punishment they decided to send a sea-monster, Cetus, to ravage the coast. Upon consulting the oracle the royal pair were told that this calamity could be averted only if their daughter, Andromeda, was chained to the rocks and the monster permitted to devour her. It so happened that the hero, Perseus, flying by on his winged horse, Pegasus, saw the maiden chained to the rocks and the monster approaching. He immediately flew to the rescue, vanquished the monster and carried off the maiden on his winged horse. As a punishment Cassiopeia was ordered bound to a chair, and, with Cepheus by her side, doomed to swing around the pole of the heavens forever. Perseus and Andromeda were married and, at the end of a happy life, were elevated to the heavens, as was also the gallant steed, Pegasus.

In all atlases depicting the members of this group, Pegasus is shown without hindquarters. The line of stars extending toward the northwest represent his head and shoulders, and another line of stars toward the southwest the forelegs. Perseus is supposed to be carrying the head of Medusa, the snaky-locked Gorgon, whom he had killed as one of his exploits. The interesting variable star, Algol, or The Demon Star, which varies periodically in brightness in less than three days, is supposed to be the baleful, winking eye of Medusa.

Algol, or Beta Persei, whose position is indicated on the star map, is the only variable star that was known to the ancients. The period of variability of this star has been found with great exactness to be two days, 20 hours, 49 minutes. One can easily observe the light changes by comparing the light of the star with a near-by star of unchanging light. The cause of the light changes of Algol was believed to be due to the eclipse of a bright star by a faint companion as far back as 1783, when the astronomer Goodricke then correctly suggested that the passing of the companion star between the observer and the brighter star temporarily cut off its light. Much has been learned about this peculiar star system since that day, and there are now known to be, in addition, some thousands of such eclipsing binaries, as they are called. The two stars are too close together to be detected except by means of the spectroscope. It is known now that the distance between the centers of these two stars is 6½ million miles. The primary, or more massive star, is about five times as massive as our own sun; the companion is about equal in mass to the sun. The primary star, although much hotter in surface temperature than its companion — 16,000 degrees as compared to 6000 degrees Centigrade — is, however, a smaller body. Its radius is about three times that of the sun. The radius of its companion is about one-half a solar radius, or more than two hundred thousand miles, greater.

From the time when the light of the brighter star begins to fail, until it regains its normal brightness, about ten hours elapse. One will find it interesting to watch the light changes of this star, composed of two stars so close together that not even with powerful telescopes can the two be seen as separate bodies. As the companion is not dark there should be a second minimum of light when the brighter but smaller body comes between us and the companion in the course of their mutual revolution. Such a secondary drop of light does occur and has been detected, although too slight to be seen visually. As it happens there are actually three stars in the Algol system, but the third body is at a distance of about 260 million miles from the center of gravity of the other two bodies. It reveals its presence only through its gravitational attraction on the other two bodies which causes their period of revolution to be slightly variable.

Also of interest to observe visually at this time is the faint luminous patch in Andromeda, in the position indicated on the chart, which is known as the Great Nebula in Andromeda. This is the nearest of the spiral nebulae, at a distance of a little less than a million light years. It can be seen in all its splendor only by means of photographs taken with long exposures with powerful telescopes. It is one of the most beautiful objects, thus viewed, of all the many remarkable forms of spiral nebulae in the heavens.

The constellation of Cassiopeia is probably as well known as the Big Dipper (Continued on page 498)

Star-Friends

By CLARA BILLINGS

What wide-spun glory in this canopy!
Fierce Taurus rushes down the western sky;
The clustered Pleiades — one lost to me —
Wrapped in the awful distance from my eye.
I cannot choose among this marked array.
At times I turn to Rigel, white and proud,
But think the twinkling blue of Vega's way
Is all of joy my heart can be allowed.
They are companions, and they give their light
To many a traveler, or a prisoner —
A window-watcher at the bars of night
Which rouses hope that day has failed to stir.
Oh who am I to say that stars have wrought
An inner peace which nothing else has brought!

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

HOUSE PLANTS IN SCHOOL

IT IS doubtful if any readers of this page can honestly say they have never seen house plants growing successfully in schoolrooms. Automatically, then, we can assume that every reader knows that, under some conditions at least, it is practical to suggest that they be grown in other rooms under similar conditions, if the rewards from their presence justify the responsibilities they incur. The responsibilities are really negligible, except in schools where janitors rule the roost and, for some reason or other, resent the keeping of plants in the room. Since this is a personal or administrative problem, which might involve clashes with the labor unions, we will ignore it here and concern ourselves with the minor responsibilities of the teacher, and with the major rewards from such plants to the teacher and to the pupils.

Before going on, let me ask you whether you have ever gone into a home where house plants were obviously favored guests and not had your host or hostess, sooner or later, ask you to share their pleasure in their plants. One of the busiest administrators I know gets great relief from sharing his interest in house plants with anyone who will listen to him. True, many house plant fans are more modest and belittle their successes, however great. But is it not possible then that a few well-cared-for house plants in a school may provide a leadership outlet for a few students who otherwise might not have such an opportunity?

I know homes obviously not favored economically, yet their windows are brightened by the blooms of beautiful and healthy house plants. In a parent-teacher meeting, would it not be possible, sometimes, to forget the usual program and ask some of the housewives present to share their accomplishments with others? An opportunity for self-expression, and for an instant in the sun, often makes other organisms than house plants bloom gloriously, and this goes for young or old.

I have been in schoolrooms where a number of youngsters had had difficulty in expressing themselves to strangers. The teacher had given these children the privilege of sharing their pride in certain plants with visitors to the room. The opportunity gave the child something material and something personal to use as a guide for his verbal expression. Even the President of the United States sometimes, foolishly or otherwise, uses notes instead of "speaking from the cuff," or "off the record." Why, then, should we ask a little child to make conversation from abstract ideas, and why should we criticize shy children for their handicap when we give them no help in getting out of their shells?

We could go on in this vein indefinitely, but there are other rewards that come to the teacher who maintains house plants in the schoolroom. A glance at the chart in the insert in this issue of *Nature Magazine*, and at other inserts that have dealt with similar plants, will show a section, usually the second vertical unit in which there is given information on the parts of the world from which these plants come. Poinsettias, African violets, geraniums, begonias, rubber plants, sansevierias do not have a common geographic origin. Any alert geography teacher can see possibilities for an exhibit in this suggestion, and the investigation might well go beyond the plants in the schoolroom to the making of a collection of samples of all the house plants to be found in the homes of the members of the class, and indicating their geographic origin on a world map.

There are so many suggestions for use of house plants in general science that obviously we cannot cover them all here. A long established and widely accepted standardized test in general science prepared by one of the nation's major leaders in this field gives us this item. "The reproductive parts of a flowering plant are roots, stems, leaves, flowers, root hairs." Only one of these alternatives is considered as acceptable. It is quite possible that you cannot easily demonstrate the reproduction of flowering plants by means of root hairs, but while science educators may accept flowers as the only answer, farmers, housewives, gardeners and students in science classes, from the kindergarten to college, are making flowering plants reproduce by means of roots, stems and leaves as well as by flowers. It is possible that in all of this somebody may be out of step, but so long as they do not know it, that is all right, I presume. Were the author of the test correct that flowers were the only reproductive organs of flowering plants, we could all honestly sing, "Yes, we have no bananas." Then, what would happen to banana splits and the United Fruit Company? If you do not happen to know the common method used to reproduce the commoner house plants, consult some of the mothers who raise house plants and who attend parent-teacher meetings. If this is not successful, look at the section on reproduction appearing in the chart section of this and of other inserts.

It seems only reasonable that every child should at some time in his life make some plants reproduce by layering, by leaf slips, by leaf-petiole slips, by division of roots, by cuttings of wood, or by other means, as well, of course, as by the use of seeds. In fact, each of these methods may well be explored. Some of these experiences might be significant to the history teacher, and even to the teacher of political science. History tells us of the great treeless plains of our mid-continent. It also tells us of the success of the pioneers in planting trees along the waterways, of their using whips to drive their draft animals, and then sticking the pieces into the ground where the whips took root and grew. I have seen parts of the country where fence posts were made of green timber and where the posts took root and grew into trees.

We know of the story of the shelter belts that were started in the West to interrupt wind erosion and to anchor water to the soil. While it is true that you can read wide-eyed about these things and can repeat it parrot fashion, how much better it would be if the ability of plants to reproduce by stem cuttings were illustrated by each child making a stem cutting of a scraggly old geranium, rooting the cutting and starting a whole series of new and vigorous plants. City children who, in our conservation programs, are asked to go out to see a beaver at work, or to avoid overgrazing their pasture land, or to be sure to plant their crops on the contour may have difficulty in following the curriculum too closely. They can, from the house plants in their schoolroom, get an understanding of the basic phenomenon that turned our treeless plains into prosperous farmlands with homes shaded by trees. They can understand from this how it is possible for Lombardy poplars in America to be almost exclusively from staminate trees, since it was from sticks of staminate trees that our American stock was developed. How would the Mormon settlements of the Rocky Mountain region look if all of their Lombardy poplars required that they reproduce by means of the flowers, as the test mentioned indicates, when the pistillate plants are usually lacking? How fortunate, too, is it that these great growths of trees are staminate and not pistillate when we see the enormous amount of fluff that comes from the pistillate plants of other poplars and from willows. The essence of this story may be in the house plants, which I hope are in your schoolroom.

Teachers whose rooms become unduly chilled in winter will find that a double box insulated with waste paper or with commercial insulation may be inverted over the plants that are set on the floor over the weekend. I have kept geraniums, coleus and begonias outside on a window sill over a weekend in winter by using such a box, and the plants were none the worse for the experience. Here is a suggestion for a simple little lesson in heat in physics.

Is it not possible that a school might, through its house plants, be instrumental in bringing brightness into many homes that now are without much to cheer a person? Why cannot a teacher afford to maintain in the schoolroom some really unique plant from which cuttings may be made to be taken home by the children and to become from then on a part of that home, serving,

we hope, as a reminder of the year one of the children had with one of the teachers. It might pay to reverse the apple polishing technique and have the youngsters take something home to mother.

Almost any of the garden handbooks that are available on the market would be useful to teachers interested in maintaining house plants in the schoolroom. Usually the State agricultural college is in position to provide some bulletin that will help, or the U. S. Department of Agriculture's Farmers' Bulletin, No. 1872, on *House Plants* may be found useful.

Western Birds

A Field Guide to Western Birds. By Roger Tory Peterson. Boston. 1951. Houghton Mifflin Company. 240 pages. Illustrated by the author in color and black and white. $3.50.

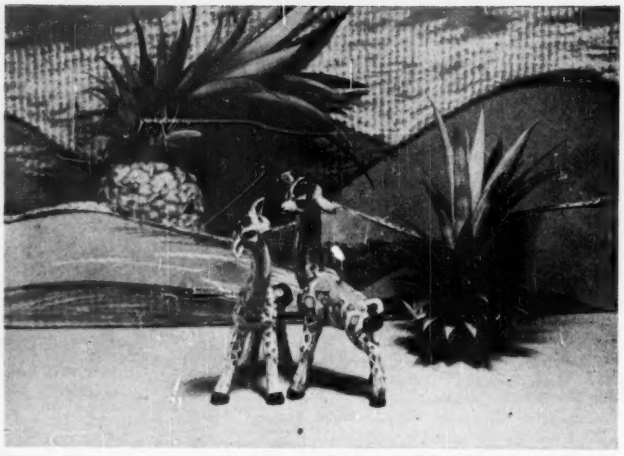
Originally published in 1941, this book quickly became a standard guide for the field identification of birds of the West. It employs, of course, the Peterson system for quick identification through emphasis on distinguishing characteristics observable at a distance. A great deal has been added to the original edition, the text has been rewritten, more information on ranges and songs included. Thus this new edition makes the book the standard for field work in the West. There are six pages in full color, forty-eight line cuts and forty pages of half-tone illustrations. This book and binoculars are complementary, one to the other, on any bird-seeking trip afield.

Bulletins Received

"Trees Forever," *The Montesano Vidette,* Montesano, Washington, is the story of the nation's first certified Tree Farm, the Clemons Tree Farm established ten years ago under Weyerhauser ownership. . . "Conservation in the Americas," edited by Annette L. Flugger, Pan American Union, Washington, D. C., is the ninth in a series of reports on Pan American conservation and deals with recent developments. . . "Citizens and Educational Policies, National Education Association, 1201 16th St., N.W., Washington, 6, D.C., discusses the public responsibility with respect to educational policies. Fifteen cents. . . "Holly Production in Oregon," by A. N. Roberts and C. A. Boller, is published by the Agricultural Experiment Station, Oregon State College, Corvallis, Oregon. . . "Annual Message of William N. Erickson" is the report of the president of the Board of Forest Preserve Commissioners of Cook County, Illinois, and reports on the Board's educational and conservation activities. . . "The World Is So Full of a Number of Things" is a teachers' manual of programs in Nature and Science for intermediate and junior high school grades and is published by the Department of Education, State of South Carolina, Columbia, S. C.

Camera Trails

By
EDNA HOFFMAN EVANS



Pineapple tops provide prickly foliage as background for this coy giraffe pair.

FOR several reasons November is a good month for tabletop photography. For one, the weather outside is not always inviting. For another, it is time to be thinking about Christmas cards, and tabletop pictures often lend themselves very well to such use.

By November, stores are showing a variety of Christmas decorations and motifs. It is not at all difficult to find "actors" and settings for holiday greeting card use. Before November, however, Santa Clauses, reindeer, and the like are harder to find. You may have to dig down into storage boxes of your own to locate them.

The term "tabletop" is rather deceiving. Tabletop pictures do not have to be taken on a table. They can be set up just as well on the floor, on the steps, on a window seat, or wherever else a desirable setting can be found. Nor does the photographer have to build an elaborate stage, as some books on photography recommend. A special stage is fine if you have the time, place, and necessary materials for it. Otherwise, your pictures can be taken just as well without it.

Heretofore, in taking tabletops, I have set up my material outdoors and have used natural light. I have chosen a shady spot and have shot slowly to make up for lack of light. After all, tabletop set-ups usually consist of inanimate objects that will stand still indefinitely.

This time, in preparing illustrative pictures for this section, I decided to try photoflood lighting — nothing fancy, just lights that would do away with both unwanted shadows and unnecessary highlights.

My "studio" probably would have thrown a meticulous photographer into a spasm. But I am not a meticulous photographer; that is, insofar as my working place is concerned. A Nature photographer has to be ready to shoot when, where, and as the situation demands.

The back porch was my studio, and I set up my scenes on the floor. That way it was easy to shoot from above and, by getting down on all fours, I could also take eye-level views.

I used three lights. The one on my right, in a clamp-on reflector, was hitched to the end of the ironing board. The one on my left was in a reflector from a goose-necked lamp and it was hooked with a clothespin to the back of a kitchen chair. From above I dropped a third light by the simple method of putting the ends of a narrow board on the two opposite windowsills and hanging the light over the middle. I had enough light to make 1/25 second exposures at f:16.

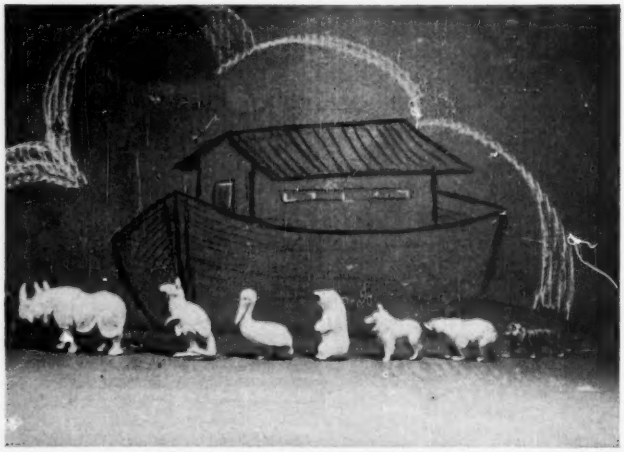
I put a large sheet of tan cardboard on the floor and for a background I used another sheet of the same. To break the line where the two joined, I used a narrower strip of cardboard, cut roughly to imitate mountains, or hills, or whatever I wished to call the wavy lines and undulations. I sketched higher ones on the background card itself.

To further the effect of distance, and to get different values of dark and light, I used a heavy black pencil and a piece of white chalk. I made no effort to make the background realistic. The up-and-down effect was caused by the ridges in the cardboard.

My first idea, in fact the one that inspired me to begin with, was to use the lead soldiers that were the favorite toys of my childhood. I lined them up in parade formation. The result, however, was disappointing. The individual soldiers are too small to show up well. There is, after all, a point of diminishing return when it comes to tabletop models. My soldiers are about three inches high. They should be two or three times that large for effective use in photography.

The Noah's Ark animals are only slightly larger than the soldiers, but they do have more bulk. Also, most of them are white and they show up better against the tan background. As for the Ark, itself, I sketched that hurriedly with pencil and chalk. With more time and effort I probably could do better, but what I was trying for was an overall, rather general effect. The animals are lined up so that they hide the place where the background and floor meet.

The picture of the two coy giraffes amuses me. I liked them the instant I first saw them in a store. Thus, they joined my ever-growing collection of gim-



Noah's Ark is roughly sketched on the background. The animals, while small, show up because most of them are white.

Toy soldiers on parade. The individuals are too small to show up well in a photograph. Figures should be larger for better results.

micks and dust-catchers.

There was no effort made here to camouflage the line between floor and background. However, I think the figures are placed far enough forward so that the line is not obtrusive. Pineapple tops provide the prickly foliage, and they do the job very well, I think. I also tried adding some bunches of grapes for further contrast but the result was too cluttered. I like the simpler picture best.

Of course none of these pictures is exactly appropriate for use as Christmas cards, but a similar technique can be used if a holiday design is what you desire.

Just remember, in the event that you plan to have a commercial finisher make your cards, that the image on the negative should be the same size that you want it to appear in the finished greeting. In other words, contact size. The negatives can be cropped, but no enlarging or reducing is possible.

If you are not rushed for time, and if you do not mind using some extra film, I would recommend experimentation. Make your set-ups and photograph them. Develop and print, then view the results critically for defects and possible improvements. Re-take the ones you like best, avoiding all the things you disliked in the first attempt. That is one nice thing about tabletop models. They will pose again and again for you as long as you like. It is not so easy to recapture scenes and settings with living models.

I like tabletop photography. It is a nice change, it exercises the ingenuity, and it can be pursued indoors when the weather outdoors is uninviting.

YULECARDS

In the event that you do not live near a good photo finisher, or if for some reason or other your local camera shop does not make Christmas cards, Yulecards, Department 124, Quincy 69, Massachusetts, will make them for you.

For a free sample, send your negative and a three-cent stamp to Yulecards. If you have no negative, a snapshot and fifty cents should be sent. There is no further obligation, but if you like the resulting holiday greeting, Yulecards will make you twenty cards and envelopes for as little as one dollar, plus ten cents for shipping.

I, personally, like photographic Christmas cards — providing they are clever, original, interesting, and in keeping with the circumstances and the season.

FOR READING

A pleasant letter from Mrs. Glen Stuart of Wakita, Oklahoma, recommends a pamphlet on "Nature Photography With Miniature Cameras," written by Alfred M. Bailey. It is published by the Denver Museum of Natural History, Denver, Colorado, but is also distributed by the Exakta Camera Company, 46 West 29th Street, New York 1, N.Y. Mrs. Stuart, like myself, is a Kine-Exakta enthusiast. So, incidentally, is Mr. Bailey, a man who has spent many years in the Nature photography field. His pamphlet is mainly a running account of experiences, but he also includes how-to-do-it information. The publication is well worth the fifty cents it costs.

Mrs. Stuart reports improved results with Kine-Exakta black-and-whites now that she is doing her own developing and printing. There are no two ways about it, the personal touch can do more in a home basement darkroom than the impersonal touch of a commercial developer can do with the most elaborate equipment.

While we are on the subject of publications, there are two new Eastman Data Books available.

The more usable of the two, I think, from the standpoint of everyday photography, is the one on "Kodak Papers."

This is a revision of a former data book, with some additions. It includes an explanation of the relationship between the negative and an appropriate printing paper. This should be of considerable value to the picture maker.

The other data book deals with "Infrared and Ultraviolet Photography." Both data books sell for thirty-five cents.

Ansco has revised its booklet on color photography and the new edition, "Color Photography Made Easy," is now available. The 98-page, well illustrated booklet sells for fifty cents. It contains the latest information concerning the uses and handling of Ansco color films and Ansco color printon, both from the picture-taking and home processing point of view. For people who want to get their color photography information from the printed page, as well as from the exacting, exasperating, and expensive classroom of trial and error. I heartily recommend the Ansco booklet,

FILM GUIDES

The Educators Progress Service of Randolph, Wisconsin, has issued two new editions of the guides to free visual aids materials. Now available is the eleventh annual edition of "Educators Guide to Free Films," and the third annual edition of "Educators Guide to Free Slidefilms."

The former now lists 2121 film titles, of which 444 have not been listed before. The latter lists 504 titles, of which 152 are new. Both editions have been re-edited and titles no longer available have been removed.

For individuals and organizations interested in visual material for use in community and educational projects of many sorts, the guides include a great deal of useful information. Subjects covered include applied arts, fine arts, health education, language arts, science, and social studies.

THEY CALL THEM "XYLEM-O-PHILES"

(Continued from page 487)

to craftsmanship, however, official wood enthusiasts explore in the forest and importers' warehouses for rare finds whenever possible. The springs of their automobiles probably take more of a beating than those belonging to any other people. For example, two members found a Florida gold mine at Miami's federal Plant Introduction Garden after the 1945 hurricane in those parts. Many exotic trees were leveled in the blow and the wood collectors worked ten full days, sawing logs from ruined species of trees from which they had never hoped to obtain specimens. Their plunder, packed away from the garden in passengers cars, included wood from more than 260 foreign trees and shrubs, and weighed tons. These are lovers of wood, and no mistake.

NATURAL SCIENTISTS NEEDED

(Continued from page 491)

FARMER: Bedford, James H., *Your Future Job*, "Opportunities in Agriculture," Occupational Research Ltd., 1950. Chapman, Paul, *Opportunities in Farming*, Science Research Associates, 1950. (.60)

GEOLOGIST: Fearnsides, W. G. and Belman O.M.B., *Geology in the Service of Man*, Penguin Books, 1944. (.35) *Geology as a Profession*, National Roster, Supt. of Documents, 1946. (.10)

GEOPHYSICIST: "Education in Geophysics" *Transactions of the American Geophysical Union*, Vol. 26, No. 3, Dec. 1945. *Geophysics as a Profession*, National Roster, Supt. of Documents, 1947. (.10)

MICROBIOLOGIST: *Bacteriology as a Career*, Institute of Research, 1946. (.75) *Handbook of Descriptions of Specialized Fields in Bacteriology*, National Roster, Supt. of Documents, Washington, D.C., 1945. (.05)

PARASITOLOGIST: "Parasitologist" in *Biology Careers Chart-Manual*, Rice Research Associates, 1950. p. 38. *Handbook of Descriptions of Specialized Fields in Zoology and Parasitology*, National Roster, Supt. of Documents, Washington, D.C. 1945. (.10)

PLANT PATHOLOGIST: Chaplin, M. M. and Novick, B., *Plant Pathologist*, Occupational Index, Inc., 1948. (.50) *Handbook of Descriptions of Specialized Fields in Plant Pathology*, National Roster, Supt. of Documents, Washington, D. C. (out of print)

PHYSIOLOGIST: *Botanist, Plant Pathologist and Plant Physiologist*, National Roster, Supt. of Documents, Washington, D.C., 1945. (.05) *Occupations for Women in the Biological Sciences*, Women's Bureau, U.S. Dept. of Labor, Supt. of Documents, Washington, D. C., 1948. (.25)

VETERINARIAN: Cannon, Grant, "The Veterinarian" in *Farm Journal*, Summer 1951. *Veterinary Medicine as a Career*, American Veterinary Medical Association, 600 So. Michigan Ave., Chicago, Ill. (free)

GENERAL: *Effect of Defense Program on Employment Outlook in Engineering and Natural Sciences*, Supplement No. 13 to *Occupational Outlook Handbook*, Bureau of Labor Statistics, U.S. Dept. of Labor, May 1951. For the duties and qualifications of U.S. Civil Service research scientists and extension specialists in most of the above fields see *Announcement 109-Agricultural Research Scientist*, and *Announcement 202-Agriculturist*. U. S. Civil Service Commission. For requirements and duties of beginning agricultural science jobs see the latest announcement for the yearly *Junior Agricultural Assistant* examination.

IN AUTUMN SKIES

(Continued from page 491)

in the northern hemisphere because, in mid-latitudes, it never sets and has a distinctive W-shape that can easily be identified; it is seen at its best in the fall in the early evening hours. Cassiopeia is also known popularly as The Lady In The Chair. It will always be found directly across the pole from the Big Dipper. At this time it is high above the pole in the direction of the zenith, while the Big Dipper is below the pole in the direction of the northern horizon. North of the 40th parallel of north latitude the Big Dipper is always completely above the horizon, even in its most unfavorable position near the northern horizon, and Cassiopeia, which has a little closer position to the pole on the whole than the Big Dipper, never passes completely below the horizon at any time north of about the 35th parallel of north latitude. Both of these constellations pass *partly* below the horizon, when below the pole, within a few degrees south of these parallels respectively. Most of the time in all parts of the United States both of thse constellations will be seen at all hours of the night and to better advantage the farther north one goes. The Little Dipper, which is much less conspicuous than the Big Dipper, is always completely above the horizon at all times north of about the 21st parallel of north latitude and always an interesting constellation to observe.

Although in autumn Cassiopeia is in fine position for observation in the evening hours, high above the pole, the conditions are reversed in the spring. Then, in the evening hours, the Big Dipper rides high above the pole and Cassiopeia is close to the northern horizon and poorly placed. In Alaska and northern Europe, and all high latitudes, these two constellations always ride high in the heavens at all times as they make their swing around the pole.

This month the Leonid shower of meteors will appear in greatest numbers after midnight on the 16th, swiftly-darting and brilliant, coming from their radiant in Leo and met by the earth head-on. Meteor showers keep one up late but are worth it.

Mercury is an evening star this month, but is poorly placed for observation even at greatest eastern elongation on November 28, as the ecliptic now makes such a small angle with the western horizon. Venus is now in the morning sky conspicuous in the southeast before sunrise. It will be farthest west of the sun on November 14. Saturn and Venus will be in conjunction on November 21, with Venus passing south of Saturn. Mars moves from Leo into Virgo this month and rises about midnight. Jupiter is now high in the east at sunset and sets a few hours before sunrise. Saturn now rises several hours before the sun It is in the constellation of Virgo west of Spica.

THE READER'S MARKET

A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings or may advertise themselves, at low cost, for things wanted; things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

AUTHORS SERVICE

"TEN STEPS to Writing Success" reveals HOW you can write stories, poems, articles for publication. Details FREE. Will Herwell, 7016 Euclid, Cleveland 3, Ohio.

BINOCULARS and FIELD GLASSES

BINOCULARS, TELESCOPES, MICROSCOPES. Our 20th year of leadership in optical values. Bargain catalog free. Brownscope Co., 24 West 45th St., New York.

SAVE 50% ON NEW BINOCULARS! Free Catalog. Free book, "How to Select Binoculars." Write today! Bushnell's, 43-N211 Green, Pasadena 1, California.

BOOKS

NATURAL HISTORY BOOKS, out-of-print, Astronomy, Meteorology, Geology, Botany, Gardening, and Zoology. Catalogs issued. John Johnson, R.F.D. No. 2, North Bennington, Vermont.

POWERFUL MENTAL TELEPATHY. Unlimited Free literature. Joseph Johnson, Globe Road, Lewisburg, Tenn.

BOOKS! Hard-to-find and out-of-print our specialty. All subjects. Send Wants! Jaher Book Service, 620-N, East 178th St., New York 57.

FREE BARGAIN CATALOGUE of Books. All subjects. National Booksellers, 1182 Broadway, New York 1, N. Y.

SECURE YOUR OUT-OF-PRINT books from the Audubon Book Service, Dept. N - 415 Lincoln Avenue, Brooklyn 8, N. Y.

BUSINESS OPPORTUNITIES

FABULOUS EARNINGS — Fascinating pastime. Growing Genuine, living miniature (Ming) trees. New sensational Business or Hobby. Astounding information FREE. Dwarf Gardens, Box 355X, Briggs Station, Los Angeles 48, Calif.

BUTTERFLIES

FOR SALE: — Fifty thousand butterflies, twelve tropicals including one Blue Morpho $2.00. List free. Ben Karp, 3148 Foothill, La Crescenta, California.

COLOR SLIDES

COLOR SLIDES of western scenes and nature subjects. Mention interests. Receive lists or approvals. Nesbit's, 711 Columbia Road, Colorado Springs, Colo.

STONE FACES of Goblin Gulch. Gorgeous 2x2 color slides of fantastic natural stone faces. Set of six slides, bound in glass, $1.00. Will C. Minor, Box 62, Fruita, Colorado.

INDIAN RELICS

4 PERFECT ANCIENT INDIAN Arrowheads $1.00. Fine Stone Tomahawks $2.00 & $3.00. 4 Fine Bird Arrows $1.00. List Free. Lear's, Glenwood, Arkansas.

KODACHROMES

KODACHROME SLIDES ON APPROVAL. Scenes, wild life, flowers. Glacier, Grand Canyon, Yellowstone, Tetons, Yosemite, Sequoia, Arizona, New Mexico and Mexico. Other Western National Parks available. Sample and catalogue 30 cents. Douglas Whiteside, Yosemite, California.

MINERALS

AUTUMN SPECIAL: Colorful Nevada jasper, 50 cents per pound; minimum five pounds. Good Cabochon material. Price lists available on gemstone, lapidary supplies. The F. E. Rankins, P.O. Box 17, Hathaway Pines, Calif.

MISCELLANEOUS

DINOSAURIAN COLLECTION Three 2x3 inch specimens of petrified dinosaur bone. One dozen 1x1 and 1x2 inch petrified dinosaur bone. One gastrolith (dinosaur gizzard stone). All postpaid for $1.25. W. C. Minor, Box 62, Fruita, Colorado.

YOUR LEATHER JACKET renovated expertly. Free Circular. Berlew Mfg. Co. Dept. 30, Freeport, N. Y.

ROCKS and MINERALS

ROCKS and MINERALS (magazine for collectors). If you collect rocks, minerals, sands, pebbles, crystals, ores, gems, *Rocks and Minerals* is your magazine. Founded 1926. Issued once every two months, 112 pages per issue, $3.00 a year (sample copy 60c). *Rocks and Minerals*, Dept. N, Box 29, Peekskill, N. Y.

SEA SHELLS

SEA SHELLS appeal to Nature Lovers. Try these offers today: 12 Attractive Land Shells, $1.00; 12 Marine Shells, $1.00; 5 Odd Marine Specimens, $1.00. List of beautiful polished and unpolished shells on request. Mrs. F. K. Hadley, Box 33, West Newton, Mass.

SEA SHELLS FROM Burch mean much to collectors seeking fine scientific material, both beautiful and rare from the world's seas. John Q. Burch, 1584 W. Vernon, Los Angeles 62, California.

STAMP COLLECTING

50,000 STAMP GRAB BAGS 25c each. Anderson, 630 Bingaman, Reading 11, Penna.

FREE! BIG UNITED STATES catalog! ! Invaluable guide and check list. Hundreds of illustrations. Harrisco, Boston 17-A1, Mass.

TAXIDERMY

ANIMALS & BIRDS MOUNTED by O. D. Cole, R. No. 1, Wisconsin Rapids, Wis.

TELESCOPES

SKYSCOPE, the full 3½" reflector, price — $25.00. Sixty power, ¼ wave aluminized mirror, equatorially mounted, ready for use. Guaranteed observatory clearness. Used by schools, universities. Straightforward descriptive literature on request. The Skyscope Company, Inc., 475N Fifth Avenue, New York 17, N. Y.

TREES, SHRUBS, FLOWERS

CONES from World's largest trees, Sequoia Gigantea. Three for $1.00. California Sierra Co., 6308 Cassino, Fresno, California.

WRITING

SELL IN THREE MONTHS OR MONEY BACK. If you can write correct English — You can write Juveniles. I have sold some 3000-3500 stories . . . articles . . . editorials . . . serials . . . series. Now I'm teaching. "Instruction — Criticism — Collaboration." Write Dept. N for terms. Will Herman Author of "My Juvenile Success Secrets" and "My Formula for Fiction." 7016 Euclid Ave., Room 328, Cleveland 3, Ohio.

I WANT NEW WRITERS to cash checks of $1 to $100 offered daily. The easiest way to write for pay. No previous experience necessary. FREE DETAILS. Saunders M. Cummings, 468-12 Independence Bldg., Colorado Springs, Colo.

Finding the Stars

An Optical Star Finder that should find wide acceptance among amateur astronomers, youngsters interested in the heavens, student navigators and others has been devised by TriGco, Linden, Missouri. It consists of a little monocular viewer into the end of which is inserted a small map of a bit of the heavens. With a pen light type battery at the end of this one sees this bit of the skies with one eye, meanwhile orienting this small image with the same piece of the actual heavens, which are seen with the other eye. Starting, for example, with Polaris as a focal point, one can move around the heavens by using one after another of the little maps. It takes a little practice to get the hang of this clever idea, but once mastered — and it is not too difficult because we accomplished it — it is a smart little gadget. And it costs only a dollar.

Bulletins Received

"The Story of Lumber and Allied Products" and "The Story of Pulp and Paper" are recent 16-page booklets published by American Forest Products Industries, Inc., 1319 18th Street, N.W., Washington 6, D.C., which will supply them to educators and conservationists on request. . . "A Biological and Economic Evaluation of Coyote Predation" is a 24-page booklet by Frank C. Craighead, Jr., and published by the New York Zoological Society and the Conservation Foundation, 185th Street and Southern Boulevard, New York 60, N.Y. It is based on extensive study and brought out in the conviction that "the coyote needs a far better break than he has been getting in many places and that programs to poison or hunt him out of existence are highly regrettable.". . . "Cutting for Profit in Southern Pine Woodlands" is Farmers' Bulletin No. 2027 of the United States Department of Agriculture and available at fifteen cents from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. . . . "Natural History and Economic Importance of the Muskrat in the Athabasca-Peace Delta, Wood Buffalo Park," by W. A. Fuller, and "Waterflow and Related Investigations in the Peace Athabasca Delta Region of Alberta," by J. Dewey Soper, are two recent Wildlife Management Bulletins of the Canadian Wildlife Service, Ottawa, Canada.

What's That Tree?

Time was when there were more different makes of automobiles than there are today, and most boys and men could tell one from the other at a glance. Today it is even less difficult. Yet the identification is made by certain outstanding characteristics of the motor car, not in terms of what the automobile engineer would call them, but just in common, everyday language. Herbert Appleton pondered this fact and wondered why people could not equally distinguish one tree from another. He discovered that many manuals on tree identification use "seventy-five-cent" words that intimidate the individual with no botanical background. So he devised a key to 150 tree species, basing it on characteristics no more complicated than fenders, hub caps, radiator ornaments and grills on automobiles. He has presented the result in a little, 25-cent booklet entitled "What's That Tree?" It is available from Forestry Enterprises, 1740 K. Street, N.W., Washington 6, D. C.

The Rangemaster

What is described by the producer as "probably the greatest advance in high power binoculars since World War II" has been announced by D. P. Bushnell and Company, 20 Bushnell Building, Pasadena, California. This is known as the Rangemaster, and supplies an entirely new experience in magnified viewing. A single glance spans about 96 percent more area, which is almost twice as much as that covered with the standard 7 x 35 mm binocular. The Rangemaster has been developed after more than a year of intensive work and research and in response to requests from sportsmen, sportcasters, bird students, navigators, airplane spotters and others for an instrument with a wider field of observation. Full details about the Rangemaster are available from the Bushnell Company at the address given.

Pacific Flora

Illustrated Flora of the Pacific States, Vol. III. By Leroy Abrams. Stanford, California. 1951. Stanford University Press. 866 pages. Illustrated. $17.50.

This is the third volume in this notable four-volume series covering every species of fern, flower, tree and shrub indigenous to the States of Washington, Oregon and California. This immediate volume contains 1980 drawings with supporting distributional data and taxonomic text, covering families from geraniums to figworts. The author has devoted more than thirty years to the preparation of this monumental and invaluable work of reference on western botany.

Animals Have Rights

Rights of Animals. By Marian Storm. Tulancingo, Hidalgo, Mexico. 1951. Published by the Author. 110 pages.

The subtitle of this book is "An Appeal to Human Beings." It is a powerful appeal. The book is published by the author, whose stated aim is: "A society in which man tries to satisfy his needs and sane desires without inflicting great or prolonged pain upon his fellow beings." And we find, on the rear fly-leaf of this publication, the statement that its contents may be reproduced provided the source is indicated, and the hope is expressed that other friends of animals will reprint it and distribute it. The book, the author asserts, is never to be sold. The text is a well-written and excellently documented discussion of man's relationship to animals; of the cruelty that he still inflicts upon them; of the steel trap; of the persistent barbarities that "civilized" man still practices upon animals. Probably no commercial publisher would dare put his imprint on the book, but we gather that the author has brought it out in the manner that she has with the hope that it may fall into the hands of a courageous publisher.

City Plants

Plants in the City. By Herman and Nina Schneider. New York. 1951. The John Day Company. 96 pages. Illustrated by Cynthia Koehler. $2.50.

This is the twelfth science book to be written by these authors, and the first in a planned "Nature in the City Series." The basic idea is, of course, to bring out the fact that there is much that can be learned of and from the plant life in urban surroundings — more, indeed, than most people realize. There is a great deal of practical information as to how one can encourage more plant life in the city, as well as data on that which is already there. The audience is from the age of nine up.

American Woods

American Woods. By Shelley E. Schoonover. Santa Monica, California. 1951. Watling and Company, 406 Wilshire Blvd. 266 pages. Illustrated in color and black and white. $7.50.

This is a manual for those who work in wood as craftsmen or as hobbyists, who collect wood, or who need a reference work on woods for designing or artistic purposes. One hundred and fifty species of woods grown in the United States have been selected for consideration. The text places emphasis on the beauty, workability, and utility of these woods. The information includes characteristics of the trees and the localities in which they may be found. Twenty-four full color plates of different woods are most helpful. This is a practical and quite different book.

Photography Outdoors

Photography Afield. By Ormal I. Sprungman. Harrisburg, Pa. 1951. The Stackpole Company. 456 pages. Illustrated in color and black and white. $7.50.

Here is a book that should answer just about every conceivable question about the techniques of photography outdoors. The author, who has been a photographic enthusiast and writer on photography for many years, advises the reader on everything from camera and other equipment to stalking wildlife with a camera. An excellent index makes the book a valuable reference work, and the illustrations, by the author and others, are graphic aids to the text. The publishers have contributed their part with a fine piece of bookmaking.

TRAILING ARBUTUS

By F. P. Reimer

OF INTEREST to nature lovers, the following experience may well hold hopes that our native trailing arbutus is far from being extinct in the northern states. It was my good fortune to have charge of a large timber cruise operation in upper northwestern New York State, during which time ample opportunity was available for exploration in the field of our native flowers. During a course in Forestry at Syracuse University many discussions arose as to the extinction of the native arbutus, mayflower. One of the profs made an unqualified statement that no arbutus would be found north of Syracuse or Utica. His statement I challenged most vociferously, even though I had not, until that time, come upon any of the species in the area mentioned. My information as to soil conditions in the northern part of New York State led me to believe that, baring extinction by human hands, this most beautiful and exclusively aromatic of our native flora would be found in this country.

My explorative nature, being thus aroused, caused me to make several long hikes into the wilds of our northern New York woods, in the late summer and fall of 1942, with no success. As spring approached and the call of the outdoors once again challenged my theory, I made a trip through a stretch of woodland about 25 miles northwest of North Creek, N. Y. A gentle southwest was blowing, and, as my dog and myself loafed along through the woods, the unmistakable aroma of trailing arbutus came to my nostrils. I am of the opinion that there is nowhere among the myriad floral odors one that even approaches the scent of arbutus. You may be assured there was no more loafing, but a definite push toward the seat of the aroma.

Perhaps ten or fifteen minutes of intense trailing brought us to a partial clearing of small undergrowth, although well covered by a high crown of hardwoods. At last we had found it. We found a bed of trailing arbutus fully five acres in extent, resplendent with small, bell-like blossoms peeping from under the fallen leaves of last year and their own leathery green leaves. I doubt whether there is another such extensive patch of arbutus in all the north country.

DEVOTION AND EMOTION

By Bertha R. Hudelson

ONE morning last summer when I went to the basement to clean the fruit room, I had no idea that I was to be entertained by an unusual and touching pantomime. Removing the top bushel basket from a stack of five empty ones, raised the curtain, so to speak and the show began. The first actors to appear were four fat, baby mice, which darted from the second basket and instantly flashed from sight.

"Hm." I thought in disgust, "more chewers to bother." I carelessly glanced into this second basket to see the mouse home. I saw no fluffy nest, but, instead, a tiny mummified mouse, somewhat smaller than the ones that had scampered offstage.

"Been dead for sometime," I mused. "I'll put it in the furnace later." I hastened into the fruit room. As I worked, I suddenly was conscious of a peculiar scratching sound that came from the pile of baskets. As I stepped to the door to see what it meant, a grown mouse, frightened from the top basket, rushed beneath a pile of kindling.

Almost immediately after I returned to my work, the scratching sound was resumed. This time I peeped cautiously through the crack of the door. Apparently the grown mouse was the mother. She had her tiny, lifeless, baby in her mouth and was trying to jump over the high side of the basket. Again and again she leaped upward, only to fall back to the bottom of the basket with a soft, scratching thud.

At last, wisely, she left the baby where she had found it and, unhampered, leaped easily to the basket's edge. Here she ran around and around, evidently considering the best way to solve her problem. She even leaped down to a ledge near the baskets and ran back and forth, hurriedly turning her head this way and that, as if choosing the ultimate route to travel after she had rescued her baby from its dangerous predicament.

Like a flash she was in the basket again, trying to leap to its top with her precious burden. Finally, I could not resist helping the determined little creature, and tilted the basket slightly. The mother mouse made a quick exit to hide in some secret corner until I retired to my watching post. Immediately she returned to take up her leaping where she had left off. Her first leap, although burdened with her mummified child, took her over the side.

Businesslike, she hurried along the ledge as if her plans were materializing just as she had expected, and then she dropped to the floor, rushed across it and through the open door of the furnace ash pit. Out of sight she investigated its dark interior and, evidently not finding the place to her liking, returned to the entrance. Suddenly just inside the entrance she discovered a narrow ledge, or shelf, and her leaping began again.

Up she went, and down she came, like a miniature jumping-jack, and raising little ash clouds, but never once relinquishing her feather-weight burden. I could not help her in this situation, but I watched until the lunch hour arrived. Then I left the undaunted mother to solve her problem herself, which she evidently did.

Later, the sifted ashes did not reveal her secret, and the small door of the ash pit prevented much investigation of that gloomy space. Consequently, no one will ever know where the mother mouse deposited her child's dried little body for its final resting place. The curtain dropped with the audience gone.

Mexican Wanderings

Biological Investigations in Mexico. By Edward Alphonso Goldman. Washington, D. C. 1951. Smithsonian Institution. 476 pages. Illustrated. $4.50.

This work by the late E. A. Goldman is a naturalist's diary of localities visited in Guatemala and Mexico, between 1892 and 1906, by Dr. Goldman and Dr. E. A. Nelson. A map shows their wide wanderings during their Nature explorations, and the day to day story is interesting reading. An excellent index makes the book also a valuable reference work.

Northern Trails

Wasa-Wasa. By Harry Macfie. New York. 1951. W. W. Norton and Company. 288 pages. $3.00.

This is a story of trails, treasure and adventure in the Far North by a Swede of Scottish descent who emigrated to Canada in 1897. He sought and found gold in the North, lived with the Indians and Eskimos and adventured widely. Originally written in Swedish, it has been effectively translated by F. H. Lyon.

Great Lakes Algae

Algae of the Western Great Lakes Area. By G. W. Prescott. Bloomfield Hills, Michigan. 1951. Cranbrook Institute of Science. 946 pages. Illustrated. $10.50.

Some 1100 algae of the fresh waters are described and illustrated in this fine work, which actually is not confined to the area indicated in the title, at least so far as many of the species treated are concerned. A specialized volume, it is of particular value to limnologists, sanitary and water engineers, botanists and fisheries biologists. In the course of the preparation of the work the author has compiled a bibliography that is outstandingly complete and valuable for itself.

Meet the Dinosaurs

The Dinosaur Book. By Edwin H. Colbert. New York. 1951. Published by the McGraw-Hill Book Company for The American Museum of Natural History. 156 pages. Illustrated. $4.00.

This is the story, in interesting and popular text, supported by charts and restorations, of the fantastic animals that existed in the distant geologic past. The author, who is Curator of Fossil Reptiles and Amphibians at the Museum, tells the reader how we are able to reconstruct the story of the past and to picture today how those creatures of long ago appeared. This is a second edition, the first having been published privately by the Museum, and this new edition covers advances in the study of fossil reptiles and amphibians since the first edition appeared.

UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

PHASE-CONTRAST MICROSCOPY

2. Phase-Contrast Microscopes

In the October issue we began a discussion of phase-contrast microscopy, which is continued here. We hope you have your October issue handy for reference, but we are here repeating two of the figures used last month for more easy reference.

The Search for Contrast

When the average microscopist wishes to observe a living amœba, in his slide mount of a drop of culture, he cuts down the light by closing the iris diaphragm of his condenser. He may or may not know that he is violating the rule for securing full resolution with a full cone of light; but he does know that he gets the result he wishes, at least for ordinary work, as the case of the biology teacher demonstrating amœba to a student. As the iris is closed, the cone of light becomes narrower and resolution diminishes. Contrast increases, however, up to the point where diffraction patterns destroy all resolution, and for that reason many workers with the microscope are content to get their contrast in this manner, at the expense of resolution.

As we have seen, staining and vital staining are partial solutions of this problem, but have limitations. *Darkfield microscopy* (Feb., 1944, issue, this Department) is another, the objects being illuminated by light from below, but so far to the side that none of the field light enters the microscope tube, the field therefore appearing black. Many rays striking the objects are deflected up the tube, however, and the objects appear to shine as if self-luminous. This reveals surface features, but may exaggerate them. *Rheinberg illumination* (Dec., 1947, issue) employs a bicolored disc, which is placed in the filter carrier below the condenser. An outer ring of, for example, red glass, gelatin, or plastic, may contain a central disc of blue. The outer ring will illuminate the object while the inner one lights the field, resulting in a red amœba against a blue background, sometimes referred to as optical staining. Any two contrasting colors may be selected. This is a stunt rather than a method of investigation; resolution of internal detail is not improved and colored lights are trying on the eyes. *Polarized light* (Nov., 1940), vibrating in a single plane, is useful only with anisotropic (doubly refracting, birefringent, or optically active) material, such as calcite crystals or horn. In fixed tissues, through precipitation or coagulation, the refractive indices of parts have been altered sufficiently so that they are no longer quite so uniform; thus fixing secures *optical differentiation*. But fresh, unstained material provides no such diversity, and contrast is poor. Phase-altering technique offers the only satisfactory answer to this problem thus far.

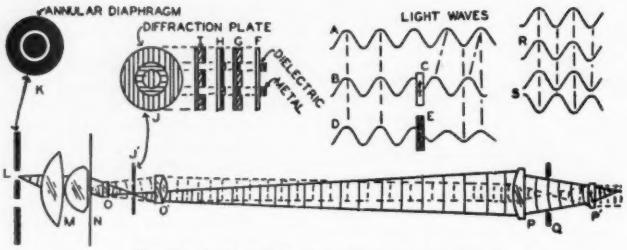


Fig. 2. A. O. explanation of phase microscopy.

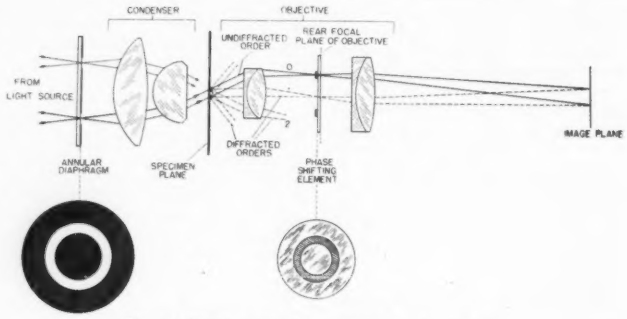


Fig. 3. B & L explanation of phase microscopy.

In brightfield microscopy it was formerly assumed from the principles of geometrical optics, that each point on a specimen transmitted or gave off light waves that could be refracted through a system of lenses, collected again at an image plane, and there each point would be reproduced, giving an enlarged real image of the specimen. But Abbe discovered that such an idea is oversimplified and false and that diffraction played a major role. In fig. 3 the object is shown breaking up incident light into two components. Some of the rays will go through the specimen detail; this is direct, central, undiffracted, or *undeviated light* (various authors prefer different terms). Other rays will diffract around the edges of particles in the specimen, forming diffracted or *deviated light*. In both figures 2 and 3 undeviated rays are shown as solid lines, deviated rays as broken lines. The deviated rays pursue longer optical paths than the undeviated ones, and arrive at the rear focal plane of the objective slightly retarded and out of phase with the undeviated rays. The various orders of diffracted spectra may be seen there as a series of maxima and minima. At this rear focal plane these various images act as secondary light sources (Huygens' principle), sending out their own wavefronts. In the real image plane, located in the eyepiece if the usual huygenian ocular is employed, the various spectra are so focused as to overlap and become visible through their interference effects, reproducing the conditions that exist in the specimen. Phase differences are seen as intensity differences, and the images are satisfactory if stained material is used. But in fresh and transparent objects, the differences are too slight to afford enough contrast. Phase altering changes these slight differences into larger ones, heightening or suppressing so as to increase the contrast.

Following Abbe's work on diffraction, K. Bratuscheck in Germany studied the phase relationships of light within the microscope (1892), A. E. Conrady (1905) discussed experimental proof of phase reversal in diffraction spectra, and J. Rhineberg (1904, 1905) wrote two papers on the influence on images of gratings of phase difference among their spectra. The major pioneer work, however, was that of F. Zernicke, a professor at Groningen, 1935, who used a diffraction plate to secure phase differences. He induced Carl Zeiss, Inc., to manufacture phase-contrast equipment for their microscopes, and this was done and reported by two Zeiss scientists, A. Köhler and W. Loos, 1941, with suggestions on the use of phase microscopy in various fields of research. C. R. Burch and J. P. P. Stock, London, 1942, used a slit type phase plate and published their results.

In the United States developments were delayed by the war. The American Optical Company, Instrument Division (formerly the Spencer Lens Co.) completed their first phase-contrast microscope in time for exhibition at the Christmas meetings of the American Association for the Advancement of Science at Cleveland in

1944. This instrument resulted from the theoretical and experimental investigations of four American Optical research scientists: — physicists A. H. Bennett, Helen Jupnik, Harold Osterberg, and biologist A. W. Richards, who published numerous papers, severally in 1944 and together in 1946.

Phase-altering Elements

We are now in a position to understand the gist of what happens in phase-contrast work and the equipment used for this purpose.

A ring type of substage diaphragm or stop is placed below the condenser, at its front focal plane (figs. 2, 3, annular diaphragm). It is similar to a darkfield stop, but the transmission ring is not so far from the center. It passes a circle of light which, after refraction through the condenser lenses, forms a hollow cone consisting of parallel bundles of rays. Unlike darkfield, these rays, after traversing the specimen, enter the objective; — the cone lies within the angular aperture of the front lens. Each size of objective requires a separate annular stop, the outer diameter of which must not be smaller than the full width of the cone of light the objective can use, otherwise the numerical aperture, and hence the resolution, will be impaired.

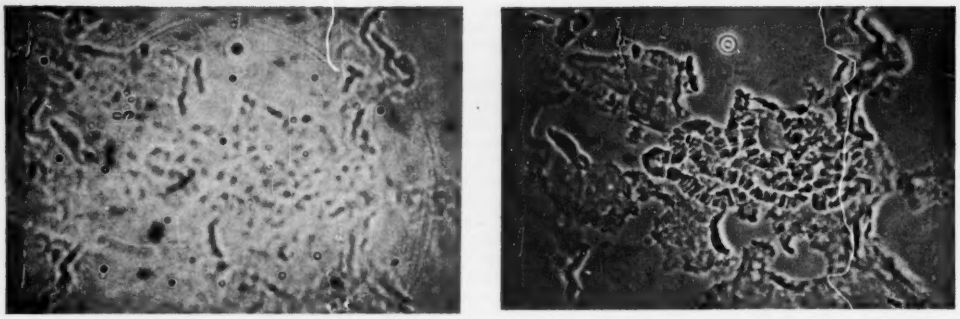
The second element needed is a phase-altering annulus, commonly called a phase plate (fig. 2, diffraction plate; fig. 3, phase-shifting element). It is placed at the rear focal plane of the objective, a position that varies according to objective; inside the lens assembly with the 16 mm and 1.8 mm, but outside with the 4 mm. This plate, like the annular diaphragm, has a transmitting circle, and this must coincide exactly with the image of the substage annulus. Centering devices are included for exact alignment. In operation, the image of the lamp filament is focused on the annular diaphragm (Köhler illumination), which now becomes the light source and provides a hollow cone of light directed by the condenser upon the specimen, and continuing as the undeviated light through the objective, producing a real image of the annulus in the rear focal plane. From here this image passes through the second circular opening, spreading out to fill the eyepiece diaphragm. If any obstruction is placed on the annulus of the phase plate, it will alter this undeviated light.

The deviated light is produced by diffraction in the fine structure of the object and goes on in numberless directions, some of the rays failing to enter the objective at all (fig. 3). Those that do are refracted by the objective so as to pass toward the rear focal plane along many paths, but mostly either inside the annulus (fig. 3, diffracted order 1) or outside (order 2). These rays continue on to the real image in the eyepiece plane (Q in fig. 2), and again there is an opportunity to alter this light by modifying the phase plate.

Stated another way, the undeviated light is confined to the image of the condenser diaphragm, whereas the deviated light has been spread out by diffraction in the specimen, knows no such limitations, and passes through the rear focal plane of the objective at any or all parts, but mostly through areas other than the diaphragm image, since these areas are greater. Consequently we may think of this diaphragm image as separating the undeviated from the deviated wave bundles, which accordingly can be worked on separately by having a diffraction plate of two parts — annulus and non-annulus.

The phase-shifting elements are made of glass of optical quality and are circular in outline. Either the annular area, the non-annular, or both may be coated so as to alter the light they transmit, or either may be left clear. The coatings are of two types. A dielectric material that is transparent but denser (of course) than air will transmit light waves but retard their velocity; a thin coating of metal will alter the amplitude of the waves, decreasing the intensity by absorbing any desired proportion. Both coatings are put on as vapors under high vacuum. Fig. 2 explains what these coatings can accomplish and should now be reviewed. Line A, under "light waves," shows an undisturbed oscillation. Line B includes the introduction of a coating of a dielectric material (C), and it is seen that the wave takes a longer time to get through this transparent but denser-than-air substance; its optical path has been increased, hence it gets out of step with the undisturbed wave, lagging behind, out of phase. The thickness of the coating times its refractive index is so adjusted that the wave B is ¼ wavelength behind A. In line D, a film of metal (E) partially obstructs the path. The amplitude of the wave or intensity of the light has been reduced by absorption of some of the light by the metal, but the light that does get through has not been retarded and is still in phase with A.

Diffraction plates F, G, H, I, of fig. 2 illustrate the four possible ways these two kinds of coatings may be combined to affect the undeviated light from the specimen, the deviated waves, or both. When metal is placed only in the annulus, the plate is designated an "A" type (FG); when placed only on the non-annular areas, the plate is a "B" type (HI). If dielectric is placed solely on the ring (FH), the optical path of the undeviated light is increased, and a plus sign is added; if placed solely on the non-annular areas (GI), the optical path of the deviated light is increased, which is to say that the path of the undeviated light is relatively decreased, and a minus sign is added. The four kinds of plates are accordingly: A+, A−, B+, B−, a poor form of nomenclature, undoubtedly transient and due to the newness of this technique. An almost infinite variety is possible, as the thickness of either the phase-retarding or the absorbing coats may be altered at will. The American Optical team, in 1946, reported on observations of more than 60 kinds of materials, using 56 different phase plates.



Left, giant salivary chromosomes, *Drosophila*, fresh, unstained, brightfield, 1150X oil immersion. Iris nearly closed; diffraction pronounced; contrast almost zero. Right, same preparation, but with A-, dark contrast, phase optics, 1150X oil immersion.

An A+ plate, as F in fig. 2, retards and partly absorbs the undeviated light without affecting the deviated light at all. If some 75% of the undeviated, i.e., central or background light is absorbed, the field seen through the microscope will be dark. Retarding this light brings it into phase, or nearly so, with the deviated (diffracted) light, which was already retarded owing to its longer optical path. Thus reinforcement occurs, and the diffraction spectra are made brighter. By this means, the edges of particles, borders of larger objects, rounded hair-like structures, and other textures that produce diffraction are rendered bright, and the effect is a pseudo darkfield. Because of the bright highlights, the picture presented by plus plates is termed *bright contrast*. Some of the terminology at this point is apt to confuse the beginner: — nomenclature in phase work has not yet had time to simmer down. Because, in bright contrast, the undeviated light is decelerated with reference to the deviated light, the condition is also termed *negative contrast*. So we have the curious situation of a plus plate providing negative contrast.

The A− plate (G in the figure) partially absorbs the undeviated light while retarding the deviated waves, yielding *dark contrast*. Since the undeviated light is not retarded while the deviated light is, and the effect is to accelerate the undeviated over the deviated rays, the result is also termed *positive contrast*, and the plate referred to as an *accelerating element*. This plate provides a background lighter than the material, and is similar to brightfield, hence most users prefer the A− to the A+ plate. The picture is more nearly like the one they expect to see in a microscope. The field is not as bright as in ordinary brightfield, since the undeviated light suffers partial absorption, but the diffraction patterns are further retarded by an additional increase in their optical paths by means of the dielectric substance on the phase-altering plate. The total retardation approaches ½ wavelength, causing partial destructive interference between the deviated and the undeviated beams. With the normally stronger undeviated light weakened by absorption, it cannot drown out the diffraction spectra, and so these usually feeble waves are relatively strengthened and can be seen more clearly. The various weak diffracted orders thus exert a much greater influence on the image and small contrasts in thin, transparent materials, normally lost in the bright flood of undeviated light, are brought out distinctly, in varying degrees, all darker than the surrounding field.

The B+ type of diffraction disc, represented by H in the drawing, has not proved as useful as the others and is not regularly manufactured. The B− type (I) is just the opposite of the A+, not affecting the undeviated light at all, but both retarding and absorbing the deviated light. This plate provides dark contrast of a nature commonly denoted by the special designation *B-minus contrast*, and is particularly suited for use with stained material, especially weak or old and faded stains, and with intra-vitam staining.

In addition to using glass discs for placement of the phase-altering substances, these may be vaporized directly upon an objective lens face. This is done in the case of the 1.8 mm objective, in which the back focal plane is within the lens system.

The two chief manufacturers in the United States take opposing views on methods of use of the phase-contrast principle. Most of the foregoing description of types of phase plates has been taken from publications of the American Optical Company. They believe that different subjects call for different kinds and degrees of contrast, and so they not only provide bright, dark, and B-minus contrast objectives, of 10X, 20X, 43X, and 97X powers, but in many cases, three *degrees* of contrast as well, — low, medium, and high, with a total of 24 objectives in all. According to their experience, the three most generally useful types are Bright Contrast-Medium, Dark Contrast-Medium, and B-Minus Contrast-Low, supplied in each of the four magnifications. The customer is given a chart showing preferred optics for a great variety of needs, and can buy as many phase objectives as desired, together with the proper annular substage diaphragm for each, and other accessories.

Bausch & Lomb, on the other hand, following Carl Zeiss, believes that all of these different elements are largely unnecessary, and offers only four objectives, 10X, 21X, 43X, and 97X, each equipped with an A− plate (dark contrast). Their catalog stresses simplicity, convenience, and efficiency. B & L objectives are calibrated for monochromatic light. The designers calculated a ¼ wavelength phase shift in the green portion of the spectrum, and so they supply a green Wratten filter to be used by the customer. If white light is substituted the phase effects will not be the same for all colors since, it will be remembered, the angle of deviation in diffraction differs for each color.

With either make of instrument, one or more phase objectives may be mounted on the same microscope nosepiece with ordinary (non-phase) objectives. There is a clear aperture in the turret condenser, containing no annulus, for use with non-phase optics. If preferred, the operator may have a separate instrument, entirely devoted to phase work.

Unfortunately for prospective customers at the present stage in the development of this new method, the equipment is expensive. Possibly further discoveries and quantity production may serve to remedy this situation in the future.

Next month we shall describe some of the applications of phase microscopy.

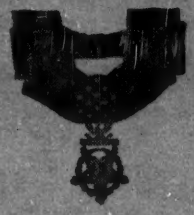
SONGS FOR THE COMPARATIVE ANATOMY LABORATORY

Gnome on the Mange

(Air: Home on the Range)

Oh I found me a gnome
On my pussycat's dome
Where the hairs in their follicles lie,
Where the cilia stand
O'er Meibomian gland
And vibrissae once wigwagged on high.
Gnome, gnome on the mange,
Are you louse? Are you flea? Are you mite?
No doubt when alive
You put jumpin' and jive
In this old roustabout of the night.

Medal of Honor



Major General William F. Dean, of Berkeley, California—Medal of Honor. In the hard early days of the Korean War, when it was Red armor against American rifles, General Dean chose to fight in the most seriously threatened parts of the line with his men. At Taejon, just before his position was overrun, he was last seen hurling hand grenades defiantly at tanks.

General William Dean knew in his heart that it's every man's duty to defend America. You know it, too. The General's job was in Korea and he did it superbly well. Your defense job is here at home. And one of the best ways to do that job is to start right now buying your full share of United States Defense* Bonds. For remember, your Defense Bonds help keep America *strong*, just as soldiers like General Dean keep America safe. And only through America's strength can your nation . . . and your family . . . and you . . . have a life of security.

Defense is your job, too. For the sake of all our servicemen, for your own sake, help make this land so powerful that no American again may have to die in war. Buy United States Defense* Bonds now—for *peace!*

Remember that when you're buying bonds for national defense, you're also building a personal reserve of cash savings. Remember, too, that if you don't save *regularly*, you generally don't save at all. Money you take home usually is money spent. So sign up today in the Payroll Savings Plan where you work, or the Bond-A-Month Plan where you bank. For your country's security, and your own, buy U. S. Defense Bonds now!

U.S. Savings Bonds are Defense Bonds - Buy them regularly!

The U. S. Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America as a public service.

All the wonders of nature are yours in PUTNAM'S NATURE FIELD BOOKS

This celebrated series is, beyond comparison the finest group of books on nature ever published. Thousands acclaim them as unsurpassed for accuracy, beauty and complete usefulness. There is a NATURE FIELD BOOK for every subject and every use. No nature lover can afford to be without them.

Field Books Have Stood the Test of Time!

- ACCURATE...
- AUTHORITATIVE...
- EASY TO USE...
- MAGNIFICENTLY ILLUSTRATED...
- STURDY AND PERMANENT...

As an example
HERE'S THE LATEST FIELD BOOK
More than 500 things to do!

Only $3.95

FIELD BOOK OF Nature Activities

By WILLIAM HILLCOURT

It contains hundreds of specific and practical suggestions for projects — things to do — things to make. It gives a broad outline of all the possible activities and a wealth of ideas for every conceivable nature hobby. The author is the National Director of Scoutcraft for the Boy Scouts and knows the why's and wherefore's of practical, fruitful nature study. There is a special section describing the making of permanent nature collections and the taking of nature photographs. It's a how-to book you'll use a thousand times over. In addition the book is profusely illustrated with drawings and diagrams.

There's a Field Book for every need:

- FIELD BOOK OF SEASHORE LIFE — $3.00
- THE SHELL COLLECTOR'S HANDBOOK — $4.00
- FIELD BOOK OF EASTERN BIRDS — $3.95
- FIELD BOOK OF WILD BIRDS AND THEIR MUSIC — $3.95
- BIRDS OF THE OCEAN — $5.00
- BIRDS OF THE PACIFIC COAST — $5.00
- FIELD BOOK OF AMERICAN WILD FLOWERS — $3.95
- FIELD BOOK OF WESTERN WILD FLOWERS — $3.95
- FIELD BOOK OF AMERICAN TREES AND SHRUBS — $3.95
- FOREST TREES OF THE PACIFIC COAST — $5.00
- FIELD BOOK OF COMMON MUSHROOMS — $3.95
- FIELD BOOK OF COMMON FERNS — $3.50
- FIELD BOOK OF COMMON ROCKS AND MINERALS — $3.95
- FIELD BOOK OF NORTH AMERICAN MAMMALS — $5.00
- FIELD BOOK OF ANIMALS IN WINTER — $3.95
- FIELD BOOK OF INSECTS — $3.95
- A LOT OF INSECTS — $3.50
- FIELD BOOK OF PONDS AND STREAMS — $3.95
- FIELD BOOK OF SNAKES IN THE U.S. AND CANADA — $3.95
- FIELD BOOK OF MARINE FISHES OF THE ATLANTIC COAST — $4.50
- FIELD BOOK OF GIANT FISHES, WHALES, AND DOLPHINS — $5.00
- FIELD BOOK OF SEASHORE LIFE — $3.00
- SHELL COLLECTOR'S HANDBOOK — $4.00
- FIELD BOOK OF THE SKIES — $3.95
- FIELD BOOK OF THE STARS — $3.00
- A BEGINNER'S STAR BOOK — $5.00
- BEGINNER'S GUIDE TO WILD FLOWERS — $2.50
- A BEGINNER'S GUIDE TO THE STARS — $2.00
- BEGINNER'S GUIDE TO SEASHORE LIFE — $2.00
- BEGINNER'S GUIDE TO FRESH-WATER LIFE — $2.00
- STORY OF PLANTS — $5.00

MAIL THIS COUPON NOW!

AMERICAN NATURE MAGAZINE
WASHINGTON 6, D. C.

Enclosed is $..... (check or money order). Please send me the NATURE FIELD BOOK(S) I have listed below:

.....

.....

.....

If for any reason I am not satisfied, I may return the book(s) within ten days for full refund.

Name.....

Address.....

City..... State.....